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WOOL PRODUCTION AND IMPROVEMENT OF THE CLIP IN CALIFORNIA

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WOOL PRODUCTION AND IMPROVEMENT OF THE CLIP IN CALIFORNIA[1]

J. F. WILSON[2]

California is one of the leading wool-producing states, with a clip normally reaching 22,000,000 to 27,000,000 pounds. In 1935 the estimated production was approximately 25,500,000 pounds. Each county in the state produces some wool, but the intensity of production in the various counties is highly variable. About 60 per cent of the clip is produced in the great interior region comprising approximately 25 per cent of our land area. Within these valley regions, nine contiguous counties in the Sacramento Valley—or slightly more than 7 per cent of the state—produce about 40 per cent of the California clip.

CHARACTERISTICS OF THE CALIFORNIA CLIP

The California clip is probably more variegated than the clip of any other state. The great diversity in altitude, climatic conditions, and soil types results in many different breeds of sheep and many systems of management. The practice of shearing twice a year in some sections and once a year in others causes the length to vary as much as the grade and character.

The California clip as a whole is predominantly a fine-wool clip. More than half of the state is mountainous, and in such sections fine-wool sheep are usually raised. On lower lands many ewes kept primarily for market-lamb production either have fine-wool breeding or represent a cross with fine-wool blood. Usually it is the smaller farm flocks that furnish most of the medium and coarse wools.

Parts of northern California produce some of the best wools in the United States. The best fine wools of Humboldt and Mendocino counties compare favorably with the best Ohio fines, and some from Tehama County are strictly comparable with Montana fine staple. Much of the clip from central and southern California, however, is short and defective.

Because of the wide difference in the clips from various sections, the state is divided into three main areas known on the wool market as north-

[1] This Extension Circular is largely a revision of Extension Circular 12, *Wool Production in California*, and supersedes it. In addition, it presents, in popular style, the results of investigations made in recent years on the improvement of the wool clip.

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ern, middle, and southern counties (fig. 1). In actual buying practice, the north-coast wools are considered separately from those of the northern interior; and some wools, notably those from Modoc County, may be

Fig. 1.—Areas of greatest wool production in California and the division of the state into three great sections.

classed as Nevadas. The great variation in shrinkage in all these areas has made it imperative to place market quotations on a clean basis.

North-Coast Counties.—The north-coast counties comprise Marin, Sonoma, Mendocino, Humboldt, and Del Norte. The bulk of the clip from this area is from Merino sheep or sheep of Merino and Rambouillet extraction. The fleeces look exceedingly bright and clean, shrink only 50

to 60 per cent, but usually lack loftiness and bulk. In general the north coast produces poorer feed than many other sections, and much hill land adapted to sheep raising is not adapted to farming. Since the sheep therefore receive little supplemental feed during winter months, many tender fleeces may be produced in adverse seasons. Coast-counties wools, particularly Mendocinos and Humboldts, are often almost white; yet they often scour out grayish or dull as compared with wools of the same grade from other sections. Sonomas are among the most beautiful wools produced in the state. They run to half blood and three-eighths blood in grade and are usually bright, lofty, and sound, although many have a heavy bur defect, especially on the bellies of the fleeces. In parts of Marin County, the blackface breeds are popular; and in certain sections of Humboldt County, notably the flatter territory near the sea, the long wools are very popular. The fleeces from these sheep constitute only a small proportion of the clip of the north-coast area. Most wools from the coast counties are of twelve months' growth.

Northern Interior Counties.—Wool from the northern interior counties is usually fine. The Rambouillet is more popular than any other breed, although some growers use fine-wool × long-wool crossbreds, and others have found the Corriedale × Rambouillet and the Romeldale × Rambouillet advantageous. The ewe bands representing the two crosses last named produce fleeces grading largely fine medium and half blood. Up to 1929 large numbers of ewe lambs sired by Hampshire and Suffolk rams were kept for breeding; but the present trend is toward elimination of blackface blood in the breeding bands of this area, and this is improving the character of the clip. Range-grown fine wools from the northern interior counties usually shrink 60 to 63 per cent. Nearly all are of twelve months' growth, and the clip is more likely to be sound than that from the coast counties. Though their heavier shrinkage makes these wools much less attractive in appearance than coast-counties fleeces, they scour out with good color. Some clips from flocks that graze a part of the year on farming lands in the Sacramento Valley may carry seed defect, but usually not enough to warrant carbonizing. Occasionally a few flocks may be shorn after the seeds ripen, in which event the bellies of the fleeces may have to be sorted out for carbonizing.

Middle-Counties Wool.—The middle-counties clip is inferior to that of the northern counties though generally superior to that of the southern counties. More of it is grown under farming conditions or where farm and range lands are combined. Although much wool produced in this section is from ewes carrying fine-wool blood, the mutton breeds are used far more than in the northern counties, so that more of the clip is

of the medium grades. Sheep in this area are usually shorn twice a year, though the practice of double shearing is partly dependent on the prevailing wool prices. When wool values are low, many middle-counties growers do not shear in the fall. As a rule the spring clip, of about seven months' growth, is fairly free of vegetable defect; the fall clip, of about five months' growth, is short, dirty, and so defective that practically all must be carbonized. Middle-counties wools are usually sound and well grown but not attractive.

The spring fine wools shrink from 60 to 65 per cent, and the spring three-eighths blood about 48 to 52 per cent. The general area of production is one of fairly low rainfall, normally with little or no rain between May 15 and September 15. Because of this dry period and the high temperature and low humidity associated with it, plus the fact that management in this section usually involves running the sheep part of the time in stubble fields, the fleeces are heavily loaded with dirt on the back. They tend to feel rather harsh as compared with northern-grown wools of the same grade.

Southern-Counties Wool.—The southern-counties clip is made up of about 70 per cent fine and 30 per cent medium. The fine wools shrink 63 to 70 per cent, are shorter in staple length, and much more defective than similar wools from the northern counties. In this area the sheep are usually shorn twice a year. Produced in a region of low rainfall, most southern wools are heavily loaded with dirt and sand and are very unattractive; but they scour out white. Short southern fines are well adapted to the manufacture of felts. A small proportion of the spring clip and all the fall clip must be carbonized. As a rule southern fleeces show less care in breeding than northern wools.

Lambs' Wool.—In most sections of California, ewe lambs to be retained for breeding are shorn in the summer or early fall. This practice arises from the belief that the lambs make better gains, especially during a wet winter, when shorn. As a rule those that are fat at marketing age, 4½ to 6 months, are sent to market unshorn; but those dropped too late to be marketed as fat springers are shorn and held over for a time or are sold as feeders. Thus a considerable tonnage of lambs' wool is produced annually in California. All is short, and nearly all must be carbonized. Lambs' wool is sold as a separate commodity, since it has certain physical properties which make it ideal for some lines of manufacture and unsuited for others.

Carbonizing.—Carbonizing consists of "burning," or reducing to carbon, the vegetable matter in wool. "Carbonized wool" is really a misnomer, for the burs, not the wool, are carbonized. The operation consists

of soaking the scoured wool in a cold solution of either sulfuric acid or aluminum chloride. After immersion for some 20 minutes, the stock is centrifuged to recover most of the chemicals used and is then heated to dryness at a fairly high temperature: drying concentrates the carbonizing agent on the vegetable matter and chars it. Next, the wool is put through crush rolls that powder the burs, and a fan removes the dust. The wool is then neutralized, if necessary, and again dried.

Carbonizing usually costs 2 to 3 cents a pound of scoured wool. The carbonized stock is slightly harsher and has a different affinity for dyes than scoured wool that has not been carbonized. Because of the costs involved, grease wools containing sufficient vegetable matter to need carbonizing are less valuable than "free" wools of the same grade and shrinkage.

Shearing Dates.—Spring shearing begins early in March, in southern California. By May 15 most of the California clip has been shorn, although some wool in the north-coast counties is usually taken off in June.

Fall shearing in the middle and southern counties begins in early August and may run into October. In general, the spring clip has had from seven to eight months' growth; the fall clip from four to five.

Moisture.—Most California wools gain in weight during warehouse storage or eastern shipment. Some, however, particularly those from the north-coast counties, gain very little or may even lose. Under normal climatic conditions at shearing time, the spring clip of the interior sections gains slightly. Practically all the fall clip of the middle and southern counties, which is usually removed during warm, dry weather, gains materially in weight, either when held in a warehouse in the San Francisco Bay region or when shipped to eastern points. The lack of standards for the moisture content of grease wools means that some growers are paid for more pounds than they have produced and others receive less than they deserve. To establish by law or regulation the "normal" moisture content of grease wool would be difficult because the wool, dirt, dried perspiration, and "grease" present have each a different capacity for moisture absorption and because the proportion of each present in raw wool varies greatly.

VEGETABLE MATTER IN CALIFORNIA WOOLS

Space does not permit a discussion of all of the different kinds of vegetable matter found in California wool. Only a few of the more important kinds are enumerated.

Bur Clover.—The bur of bur clover (*Medicago* spp.) is by far the greatest enemy of the California clip. It is often called the "spiral" bur

Fig. 2.—Seeds and burs commonly found in California wools: *A*, common cocklebur; *B*, spring cocklebur; *C*, horehound; *D*, clover bur, or spiral bur, the lower portion showing various stages of opening; *E*, broad-leaf filaree; *F*, red-stemmed filaree; *G*, star thistle; *H*, bronco grass; *I*, foxtail, or barley grass; *J*, devil's claw.

because of its construction (fig. 2, *D*). The tiny spines make its removal very difficult. Though an occasional bur is not a serious obstacle, the presence of any considerable number makes carbonizing necessary. When the wool is scoured, the spiral bur often unwinds itself into a narrow thread from 1 to 2 inches long; and unless the scoured wool is subsequently carbonized, the burs may cause serious difficulty in spinning or may actually become woven into the cloth. Because the burs, which cover the ground in summer after the parent plants have dried up, are palatable and nutritious, wool growers consider bur clover an asset rather than a liability. The spiral bur, though found in most sections of California, thrives best in the middle and southern counties on rich land. The fall wools are particularly subject to contamination by it. Whenever possible, the wool grower should shear his flock in the spring before the various kinds of burs and seeds ripen. Often a clip that would be classified as free or nearly free (of vegetable matter) will, in a week or 10 days after the seeds ripen, become so infested with vegetable matter that it must be classed as defective.

Cocklebur.—The cocklebur (*Xanthium* spp.) is less prevalent than the spiral bur, although some clips contain so much that their value is greatly depreciated. The presence of a few cockleburs (fig. 2, *A* and *B*) is not serious, as textile machinery can remove them in the ordinary processes of manufacture. A heavy infestation makes carbonizing necessary.

Foxtail, or Barley Grass.—Foxtail (*Hordeum* sp.) is found in most California wools. Spring wools, which are usually shorn before the foxtail ripens, are fairly free of this seed; but fall wool and lambs' wool are often badly infested. Since foxtail seeds have no large spines (fig. 2, *I*) they are less objectionable than the spiral and the cockleburs.

Filaree, or Alfilaria.—Filaree (*Erodium* spp.) is found over most of California. The seeds are shaped like tiny spears (fig. 2, *E* and *F*). Upon maturity the long tail or appendage to the seed becomes twisted like a corkscrew. Filaree seed is very difficult to remove from wool without carbonizing.

Star Thistle.—The seed pod (fig. 2, *G*) of the star thistle (*Centaurea* spp.) is somewhat smaller than the common cocklebur; the spines are longer, sharper, and less numerous. The plant is common in the Sacramento and San Joaquin valleys. Though more troublesome to remove mechanically than the cocklebur, it is a less serious defect than the clover bur.

Bronco Grass, or Brome Grass.—Bronco grass (*Bromus* spp.) is found widely distributed in the central valleys. The seed (fig. 2, *H*) sometimes

partially disintegrates in wool scouring, and fiberlike strands may go through all the textile processes. It is difficult to remove with ordinary textile equipment.

Barley and Wheat.—Awns from barley or wheat are often found in California wool because the sheep are commonly grazed on stubble fields after harvest. These awns become so flexible from the moisture applied to wool during its manufacture that they will sometimes remain in the finished cloth.

THE GRADES OF WOOL

Why Wool Is Graded.—The diameter or thickness of individual wool fibers varies from about $\frac{4}{10{,}000}$ inch in fine Merino wools to about $\frac{20}{10{,}000}$ inch in some of the long wools. Thus the so-called "improved" wools from well-bred sheep show a difference of roughly 500 per cent in the average thickness of the fibers from different breeds.

It is mechanically impossible to make soft, full-handling goods for men's and women's wear from coarse wool; it is likewise impossible to make good linings, rugs, and flag bunting from fine wool. The diameter of the fiber, then, or its fineness, largely determines what that particular wool is suitable for—hosiery, hats, men's suits, fine knit underwear, or sports goods.

Textile machinery of nearly all kinds either is designed to handle only certain types of wool or must be readjusted for each type. No one adjustment of the various machines adapts it to handle all wools. Grading, therefore, is not done for convenience; it is an absolute necessity. The more involved the textile processes, the greater the necessity for grading. It is far more necessary to grade wool than to grade edible products such as fruit.

Wool is graded according to its fineness or diameter of fiber. In general, the grade is determined only by fineness; but other factors, such as extreme length or marked uneveness in quality, occasionally cause a fleece to be placed either above or below the grade in which it would normally be thrown.

As the United States is now changing from one system of grade nomenclature to another, both systems will be explained.

The English or Spinning-Count System.—The English nomenclature originated through the practice of basing the grade name upon the number of hanks of yarn that could be made from a pound of combed wool or top. The hank was 560 yards. Thus 1 pound of scoured wool of 64's quality or fineness would make 64 hanks of yarn, each 560 yards long,

while a coarse wool of 40's quality would make only 40 of these hanks. This nomenclature became fixed through long usage in the wool trade; and though today, largely because of changes in manufacturing processes, the terms no longer have exactly the definition given above, they are still used. It is now possible to spin some wools to a much higher spinning count than that ascribed to indicate the grade. In fact some fine wools have, for demonstration purposes, been spun as high as 200 counts. This means that over 63 miles of yarn have been made from a pound of combed fine wool. In textile mill practice, however, wools are not usually spun so high as is indicated by the spinning count. The coarser wools are never spun so high as the indicated count.

The term "quality" following the spinning count is often used to designate fineness of fiber alone. To be classified as a "spinner's 64's" or a "spinner's 56's" the wool must have not only the desired fiber diameter but also sufficient length to permit its being spun to the desired yarn. For example, a wool may be described as a "64's quality" without possessing the requisite length to classify it as "spinner's 64's." In other words, such wool would be a 64's if it were longer.

Ordinarily no spinning count above 80's is recognized in the wool markets of the United States, and all exceptionally fine wools are thus commercially grouped together. In some countries, however, counts up to 120's are used to describe fineness. American textile methods make unnecessary a sharp differentiation in fineness above 80's although breeders of fine-wool sheep would find it convenient to use for descriptive purposes.

The United States System.—Until now the United States has employed grade names used by no other country in the world except Canada. These terms are fine, half blood, three-eighths blood, quarter blood, low quarter blood, common, and braid. The use of the word "blood" probably originated when the Merino sheep, so predominant in this country early in the nineteenth century, began to be crossed with other breeds. A wool slightly less fine than the pure Merino was presumed to have been shorn from a sheep one-half Merino and one-half some other breed. Similarly, a three-eighths blood wool represented a sheep three-eighths Merino and five-eighths something else. These grade terms no longer refer to the breeding of the sheep from which the wool is taken, but are simply arbitrary trade names, concerned solely with diameter of fiber. Thus a purebred registered sheep of one breed may produce a fleece that would grade half blood, while a registered animal of another breed may produce quarter-blood wool.

The United States grades have been regarded with disfavor for some

time by manufacturers, dealers, and growers. The terms are misleading, being no longer related to the origin of the wool, if they ever were. The number of grades, furthermore, does not permit sufficient differentiation between wools of varying fineness. Wools that would grade as 64's, 70's, or 80's under the English system are all grouped together and called "fine" by those working under the United States grades. Some graders have adopted such terms as "high three-eighths blood," "high half

TABLE 1

UNITED STATES GRADES AND SPINNING-COUNT STANDARDS

Official standard wool grades	Corresponding United States grades	Official standard wool grades	Corresponding United States grades
80's, 70's, 64's	Fine	50's, 48's	Quarter blood
		46's	Low quarter blood
60's, 58's	Half blood	44's	Common
56's	Three-eighths blood	40's, 36's	Braid

blood," to describe wools slightly too fine or slightly too coarse to be strictly representative of the grade in which they are placed. The English system, by furnishing more grades into which wool may be placed, avoids this difficulty.

Official Standard Grades.—The United States Department of Agriculture, through the Bureau of Agricultural Economics, established "Official Wool Standards" in May, 1923, using the United States grades. Before this time each dealer or manufacturer decided for himself just what fineness of fiber defined each grade.

Realizing the disadvantages of the United States grades, the Department of Agriculture in 1926 promulgated new standards, using the British system of spinning counts to designate fineness. These standards have been operating too short a time to have effected any radical change in methods of grading wool. Since more grades are included than were previously used and since the nomenclature is international, probably the old grade names will eventually become obsolete, and wool grading will be based entirely upon spinning counts. The adoption of the standards, both old and new nomenclature, is optional with the trade except in United States licensed warehouses, where their use is obligatory. The optional feature has been and is still partially responsible for the failure of the standards to become more widely adopted.

Even with the official standards, grading is done only with the eye. There is as yet no strictly scientific standard to adhere to; and it would be difficult to place commercial grading on a scientific basis.

The Bureau of Agricultural Economics in Washington has mounted, on heavy cardboard, samples of wool representing the official grades. These are arranged in sets, showing the minimum fineness required for each particular grade. They may be obtained upon application to the bureau mentioned.

A list of the standards based on spinning count of the wool is given in table 1, with the corresponding United States grades.[3]

How Wool is Graded.—For a description of wool grading see page 33.

THE CLASSIFICATION OF WOOL

Each of the first five grades is classified according to length of staple. The classifications are strictly combing, French combing (or baby combing), and clothing. Strictly combing wools are long enough to be combed by the English system of worsted manufacture. French combing is a shorter wool, one that can be combed by the French system. Clothing wools, too short to be combed profitably, are used in goods other than worsted.

The fact that a fine wool must be 2 inches long or more in order to meet the official description of combing wool does not mean that wools of shorter length cannot be combed. Both the English or Noble comb and the French or Heilmann comb can be set for a much shorter fiber than that demanded by official standards. Combing very short wools, however, greatly increases the percentage of by-products (see "noils" in the Glossary) and also the labor costs. The official length indicates the length of staple of a well-grown wool that can be profitably or economically combed without excessive waste in material or labor.

The length of wool in any classification depends upon the grade. The coarser the wool, the longer it must be in order to be classed as combing wool. The United States Department of Agriculture has established standards for lengths, as shown in table 2.

Common and braid, the last two and the coarsest of the seven grades, are not classified according to length. Although length classification is given for quarter-blood and low quarter-blood in the official standards, market reports on these two grades often do not state whether the price is for wools of combing or of clothing length. In such a case the wools

[3] A more complete description of the official grades may be found in: United States Department of Agriculture Bureau of Agricultural Economics. Official standards of the United States for the grades of wool and wool top. U. S. Dept. Agr. Bur. Agr. Econ. Service and Regulatory Announcements 100:1–12. 1926.

quoted are always assumed to be combing. As a rule the coarser the fiber, the longer it is; and quarter-blood and coarser wools are nearly always of combing length.

Cloth made from wool and used for suiting, overcoats, caps, and other wearing apparel usually falls into one of two classes—worsted or woolen. The worsteds are made from combed wools only; the woolens from carded wools that have not been combed. Wool of combing length can be used for making woolens; but the clothing wools are unsuited to worsted manufacture because of the waste involved in combing them. Most

TABLE 2

STANDARDS FOR LENGTHS ESTABLISHED BY THE UNITED STATES DEPARTMENT OF AGRICULTURE

Grade	Strictly combing length	French combing length	Clothing length
	inches	*inches*	*inches*
Fine	Over 2	1¼ to 2	Under 1¼
½ blood	Over 2¼	1¼ to 2¼	Under 1¼
⅜ blood	Over 2½	1½ to 2½	Under 1½
¼ blood	Over 2¾	1½ to 2¾	Under 1½
Low ¼ blood	Over 3	2 to 3	Under 2

worsteds are characterized by a smooth, clear surface because theoretically their fibers are all lying horizontally in the yarn, and the fiber ends are not exposed. Woolens, on the other hand, do not have a smooth surface because the wool has not been combed; hence the fibers constituting the yarn are theoretically lying in every conceivable direction. Furthermore, the carding of both worsteds and woolens is done in ways expressly to achieve such results.

For men's wear and for some other goods, worsteds are more popular than woolens; combing wools for worsted manufacture are therefore in greater demand than clothing wools. The price of wool of combing length, therefore, is higher than the price of clothing wool of the same grade *on a clean basis.*

The American public in general demands soft fabrics, with a resulting demand for the finer grades of wool from which such fabrics can be made. The most important use of wool in this country is for men's wear; and for this purpose—for suitings and overcoat material—the grades most acceptable are 56's and finer. The medium grades have been more commonly used for knit goods and sports wear. The demand for the various grades and the uses to which they are put are greatly influenced by fashion, as is also the total wool consumed.

As the French system of worsted manufacture centers around the finer grades, quotations on French combing wools are seldom given for grades coarser than 58/60's or half-blood.

The importance of length of staple cannot be overemphasized. It has been shown that among the finer grades the wools long enough to comb are more valuable than those too short to comb. Furthermore, in any grade increased length of staple is accompanied by increased fleece weight and decreased shrinkage. The United States Department of Agri-

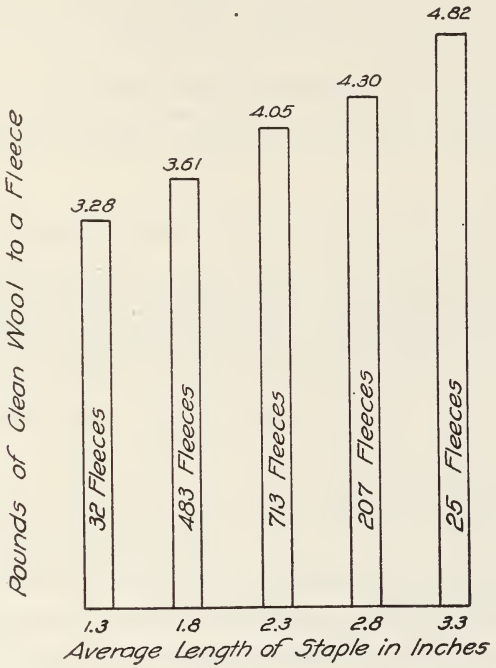

Fig. 3.—The relation of clean or scoured wool in a fleece to length of staple. (Courtesy of United States Department of Agriculture.)

culture Bureau of Animal Industry,[4] in a scouring test involving 1,460 fleeces, found that the average scoured weight of Rambouillet fleeces varied directly with the length. The data secured are presented graphically in figure 3.

Comparison of California and Territory Wools.—California wools do not command the prices brought by territory wools of similar qualities. California northern counties, a fine combing wool, is usually quoted 5

[4] Spencer, D. A., J. I. Hardy, Mary J. Brandon. Factors that influence wool production with range Rambouillet sheep. U. S. Dept. Agr. Tech. Bul. 85:1–48. 1928.

cents a pound less than Montana fine staple, also a fine combing wool. The differences between California northern, middle, and southern counties wools have previously been discussed (pp. 4–6). California northern-counties wool is less uniform in type than territory fine staple, nor is it usually so long. In addition, the California wools of all types are liable to contain more injurious vegetable matter than wools of the "territory" states.

California wools are often less carefully grown and less carefully prepared for market than the territory clips. These factors tend to decrease the popularity of our product. Some manufacturers refuse, at present, to use California wools at all. Growers in this state should seriously attempt to improve the clip by more careful selection of rams, and they should particularly emphasize the preparation of the clip for market. Only by so doing can they overcome the prejudice against California wool.

BREEDING FOR WOOL IMPROVEMENT

The wools of this or any other country must be improved largely through rams possessing the right type of fleece and having the ability to transmit desirable fleece characteristics to their offspring. An average range ewe, during six or seven years of usefulness, will produce from 5 to 8 lambs; a range ram, bred to 35 ewes each year over a period of five years, should sire 150 or more lambs. The axiom that "the ram is half the flock" may be taken almost literally.

In selecting rams for wool improvement, the breeder must first consider whether the breed is adapted to the country and whether the rams have the necessary constitutional vigor and conformation to thrive; otherwise even the best-fleeced individuals will not be satisfactory. Rams of the blackface breeds will not effect wool improvement among western ewes. The choice of breeds, consequently, is limited to the Merino, Rambouillet, Corriedale, Romeldale, and Columbia, or to some cross between the fine-wool breeds and the long-wools.

The range sheepman should select the animals individually, not as a group. Many wool growers tend to buy rams in lots and to assume, because one or two individuals have good fleeces, that the entire group is satisfactory.

In going over the fleece on the animal, one may be guided by the following scale, a modification of that suggested by Hill and Bray. It is given here simply because it lists the points to be considered in fleece judging and shows the relative importance of each. The grower is not expected actually to use a score card in selecting rams.

SCORE CARD FOR THE UNSHORN FLEECE OF RAMS TO BE USED FOR WOOL IMPROVEMENT

QUALITY OR FINENESS. Producing a grade of wool typical of the breed. Not a mixture of fine and coarse fibers within the staple. Not a wide difference in fineness between shoulder and lower thigh or britch	20
LENGTH. Should be clearly of combing length for the grade. If of twelve months' growth, fine-wool breeds should produce on the shoulder a staple of 2¾ to 3½ inches; medium-wool breeds suitable for effecting wool improvement, 3½ to 5 inches; long-wool breeds 6 to 10 inches or over. Little variation in length over the main parts of the fleece. Minimum of short wool	18
PURITY. No hair, kemp, black or brown fibers. Cut heavily for beard hairs on wrinkles of fine-wool breeds and for coarse hair on the britch of all breeds and crossbreds	16
CHARACTER. Fiber evenly crimped throughout, crimp close and distinct, fibers parallel in the staple except for sufficient cross fibers or binders to hold the fleece together. Tips free from wastiness, not frowzy. Soft, springy, and elastic	12
COLOR. Light-buff color to white. Fairly even in color over main parts of fleece	6
CONDITION. Yolk moderate in quantity and evenly distributed in the staple. Not clotted, sticky, or gummy	10
DENSITY. Fine wools should be sufficiently dense to prevent dirt from penetrating far into the staple on the shoulder and sides. Avoid loose-wooled individuals of all breeds, but remember that *extreme* density may be associated with short staple	18
	100

The University of California advocates the following procedure for those who wish to supply their own ewe lambs for replacement stock, rather than buy ewes from others:

The number of ewe lambs needed for replacement and increase is determined by the grower. A little more than twice this number of breeding ewes will be required to supply the required ewe lambs, since half the lamb crop will be males and since losses will occur. The breeding band is carefully gone over, and only ewes with the best conformation and fleece are selected as prospective mothers of the ewe lambs to be retained. These ewes are then marked, preferably with a metal ear tag, for easy identification. When the breeding season is at hand, the selected ewes are put together as one band and are mated with rams especially selected for effecting improvement. The plan utilizes the advantages to be gained from mating the best ewes with the best rams.

Value of a Good Range Ram.—When wool and lambs are quoted at prices enabling an intelligent grower to make a profit, the price at public auction for range rams of the so-called "wool breeds" is usually about $30 to $35 a head in California. Some growers prefer to buy the ram-

breeder's culls at $15 to $20 each, and a very few are willing to pay $50 to $75 apiece. Occasionally a range sheepman can be found who will pay $100 to $150 each for one or two stud rams to breed to selected ewes for raising replacement stock.

The question arises as to how much one is justified in paying for range rams to sire desirable ewe lambs for breeding. Suppose we have two rams, one at $20 whose ewe offspring shear 8½ pounds of fine French combing wool on an average, and another at $50 whose ewe offspring shear 9 pounds of fine strictly combing. Is the $50 ram worth the difference in price?

Allowing 3 rams to every 100 breeding ewes, the $20 ram and the $50 one will each sire about 33 lambs a year. On a basis of 90 per cent lamb crop marketed, this number is reduced to about 30 lambs; and of the 30, one-half are ewes. Granting a useful life of five years to the rams, each has, then, 15×5 or 75 ewe offspring in the flock. If these ewes live, on an average, for five years, the 75 ewes sired by the $20 ram will have shorn a total of $75 \times 5 \times 8\frac{1}{2}$ or 3,187.5 pounds of wool; and the 75 ewes sired by the $50 ram will have shorn a total of $75 \times 5 \times 9$ or 3,375 pounds of wool. The more expensive ram will thus have increased the clip by 187.5 pounds more than the cheaper one. Assume now that the entire clip is sold strictly on its merits. A "normal" price of, say, 84 cents a pound, clean basis, for the strictly combing wool would mean that the French combing would be worth approximately 80 cents a pound, clean basis. If a shrinkage of 62 per cent is allowed on the strictly combing, the French combing from the same clip would probably shrink 64 per cent. The wool produced by the offspring of the "cheap" ram would be worth, on the ranch, about 24.8 cents a pound, while wool produced by the ewes sired by the "expensive" ram would be worth 27.9 cents. The 3,187.5 pounds from the progeny of the $20 ram would thus bring a total of $790.50 over a period of five years, while the 3,375 pounds from the offspring of the $50 ram would return $941.62. The difference in favor of the $50 ram is $151.12. (For methods of calculating wool values, see p. 27.) Even on a flat-rate basis of wool prices, at 24.8 cents a pound, the offspring of the better ram will return $46.50 more than the poorer one.

Nothing in these statements should be construed to mean that $20 will always buy a poor ram, or that $50 will always buy a good one. A proper interpretation is that good range rams are far more productive of cash profits, on a basis of wool income alone, than poor ones. Every breeder of purebreds produces many rams that should be, but are not, castrated and sent to the butcher. Breeders are hardly to blame; they cannot distinguish good animals from poor ones at one to three weeks,

the usual age for castration. As a result the breeder keeps everything except the "knotheads," and the following year finds him with a few yearlings for sale cheap. Most of these cheap rams have faults all too obvious—crooked legs, sway-backs, undersized bodies, overshot or undershot jaws, and the like. Unfortunately many fine-looking, rugged rams

TABLE 3

CLASSIFICATION OF THE POPULAR BREEDS OF SHEEP AND THE GRADE OR GRADES OF WOOL PRODUCED BY EACH BREED

Classification	Name of breed	Grade	
		Spinning-count system	United States system*
Fine-wool breeds	American Merino	64's-80's	Fine
	Delaine Merino	64's-80's	Fine
	Rambouillet	60's-80's	Fine and fine medium
Middle-wool or medium wool breeds	Blackface or "Down" breeds: Southdown	56's, 58's, 60's	½ blood, ⅜ blood
	Hampshire	50's, 56's	⅜ blood, ¼ blood
	Shropshire	50's, 56's	⅜ blood, ¼ blood
	Suffolk	50's, 56's	⅜ blood, ¼ blood
	Oxford	46's, 48's, 50's	¼ blood, low ¼ blood
	Dorset	50's, 56's	¼ blood, ⅜ blood
	Romeldale	56's, 58/60's	½ blood, ⅜ blood
	Corriedale	48's, 50's, 56's, 58's	⅜ blood, ½ blood, ¼ blood
	Cheviot	50's, 56's	¼ blood, ⅜ blood
	Tunis	50's, 56's	¼ blood, ⅜ blood
Long-wool breeds	Lincoln	32's, 36's	Braid
	English Leicester	36's, 40's	Braid, common
	Border Leicester	40's, 46's	Common, low ¼ blood
	Cotswold	36's, 40's	Braid, common
	Romney	40's, 44's, 46's, 48's	Low ¼ blood, ¼ blood, common.

* The grade listed first for each breed is that most likely to be found among typical representatives of that breed.

of good conformation have fleeces too short in staple, too open, uneven, or lacking in character. Such rams are everywhere to be found. They constitute the real reason why the range sheepman should make his selections on an individual rather than a group basis.

CROSSBREEDING FOR WOOL PRODUCTION

The breeds of sheep are classified into three groups, based on the kind of wool produced. Table 3 shows the breeds most popular in California, together with the grade or grades of wool normally produced.

When two pure breeds of sheep are crossed, the fleeces of the resulting crossbreds tend to follow a blending type of inheritance. Thus when

sheep of a fine-wool breed are mated with representatives of a long-wool breed, the fleeces of the crossbred animals will average in fineness about midway between those of their parents. An illustration is furnished by the origin of the Corriedale breed, which resulted largely from interbreeding crossbred Lincoln × Australian Merino, although some admixture of Leicester blood has been recognized. Crossing Lincolns with Merinos produces crossbreds carrying medium wool, thus:

Braid × fine = medium (three-eighths blood)

When two breeds are crossed, however, more variation is to be expected among the offspring than results from matings within a breed. When a long-wool sheep is mated to a fine-wool or to a medium-wool sheep, a few of the crossbreds will have fleeces approaching that of one parent in fineness; but the majority will incline to represent a blend of the sire's and dam's fleeces.

Knowledge of the mode of inheritance of wool fineness has been utilized by many growers. Crossbreeding of the Lincoln, Cotswold, or Romney with Rambouillet ewes is common in the western states. In some instances such crossbreds have been interbred to develop new types and breeds more suitable to certain localities and conditions. The Columbia, resulting from interbreeding crossbred Lincoln × Rambouillets at the United States Sheep Experiment Station at Dubois, Idaho, is an example of such a type. The Romeldale, a new breed, with organized registry, represents the work of A. T. Spencer and Sons, Gerber, California, in interbreeding the crossbred Romney × Rambouillet. The Panama, resulting from interbreeding crossbred Lincoln × Rambouillets, is a type sponsored by Laidlaw and Brockie, Muldoon, Idaho.

The wool grower in the western range states has found that lambs of the blackface or Down breeds are more satisfactory for the market than any other. Since the income of most sheepmen is largely derived from the sale of lambs, the breeding policy should secure as large a number of lambs as may properly be raised and marketed, and yet produce as much wool from the ewe band as possible. Experiments have shown that there is little relation, if any, between the fleece weight of a ewe and the weight of her lamb at weaning. Ewes that produce heavy fleeces may also produce heavy lambs. While the blackface breeds are very prolific, they are hardly suited to range conditions because, as compared with the fine-wools, they lack hardiness and also because they are generally light shearers, have poor herding instincts, and tend toward black on the heads and shanks. Though the fine-wool breeds are hardy, adapted to range conditions, and produce heavy fleeces, they are generally less pro-

lific than the mutton breeds, and the lambs are not favored by butchers. The long-wool breeds, though heavy shearers, are not adapted to range conditions. The wool is coarse, and the lambs are inclined to grow rather than fatten.

The extent to which crossbreeding will successfully combine the good qualities of the various classes of sheep depends partially upon the district in which the flock is maintained. In certain range sections of California, especially in isolated mountainous areas, Merinos and Rambouillets seem better adapted than crossbreds. Flock owners should study carefully the adaptability of the various breeds to local conditions. A certain breed that may thrive well in one part of California may be inadaptable to another section. Generally speaking, the more nearly the country simulates that in which a particular breed originated, the less trouble will be experienced in acclimatization.

Sheep moved to an area poorer in feed than that in which they have been raised will often lose their thrifty condition and may give the owner trouble at breeding time. Not uncommonly rams raised on the fertile lands of the Sacramento and San Joaquin valleys and then transported to mountainous areas for service prove poor breeders. Especially is this true of rams that have been housed and pampered.

The crossbred long-wool × fine-wool ewe, in sections that permit the production of early milk lambs, has some distinct advantages over either the blackface or fine-wool. Such ewes yield practically as much grease wool as the fine-wool breeds and from 1 to 3 pounds more than the Down breeds. The staple is longer than is usually produced on either the Hampshire or Shropshire; the fleeces are quite free from black fiber, and have a softness and loftiness not found among wools from the blackface breeds. The grade of the wool from the crossbred, however, may be identical with that from the blackface.

The use of the Romney for crossing with fine-wool ewes is increasing in popularity in certain sections of California. This cross yields a heavy fleece somewhat finer in fiber than either the Lincoln × Rambouillet or the Cotswold × Rambouillet. The superior length of its wool as compared with that of the same grade from the blackface breeds makes the Romney crossbred particularly well suited to the Sacramento and San Joaquin valleys, where shearing is usually done twice a year. A much larger percentage of the spring clip from Romney × Rambouillet ewes classifies as strictly combing than can be produced in the same growth period by blackface ewes of similar ages.

The Cotswold × Rambouillet crossbred produces mostly three-eighths-blood wool of combing length and exceptional brightness. This cross has

been criticized, however, for the unevenness of the fleeces, which tend to run out or become coarse and hairy on the thighs and britch.

The Lincoln × Rambouillet cross has been widely used in sections of the Rocky Mountain region. It produces a heavy fleece grading generally 48's, 50's, or 56's—not so fine as among Romney × Rambouillets.

The use of rams of the Down breeds for producing market lambs has been recognized as good practice in most sections of California, especially the interior valleys. The use of such rams to the exclusion of other breeds has invited sheepmen to reserve for breeding purposes a portion of the ewe lambs of the blackface cross. Though rams of the Down breeds are ideally adapted for market-lamb production, their use as progenitors of the breeding ewes cannot be recommended if quantity and quality of wool production are sought. Ewes carrying a predominance of blackface blood tend to be light shearers, particularly with advancing age. The staple is too short, especially when the ewes are shorn twice a year. The wool suffers from the presence of black fibers on the heads and legs. The widespread custom of saving for breeding purposes grade or range ewes which are the offspring of blackface rams has done much to bring upon California wools the criticism of dealers and manufacturers. The use of the Down breeds, except for producing purebreds, should be largely confined to small farm flocks where wool production is not of paramount importance and to range flocks so managed that none of the lambs sired by Down rams will be kept for breeding.

The crossbred ewe of any type presents a problem in perpetuating her kind. Suppose, for example, that a grower has crossed his fine-wool ewes with Lincoln rams, expecting to keep the crossbred ewe lambs for breeding purposes and gradually to eliminate the ewes of fine-wool breeding. When the crossbred ewes are old enough, he may breed them to Hampshire, Shropshire, or Suffolk rams in order to produce market lambs. Ewe lambs sired by these rams, if reserved for breeding, will be unsatisfactory in both fleece weight and fleece character; and yet the sale of all the lambs will eventually necessitate the purchase of a new supply of crossbred ewes for breeding purposes. The alternative is to reserve enough first-cross ewes to be bred to rams other than blackface, to keep the ewe band up to a constant numerical level. To continue the production of first-cross ewes means the continual maintenance of enough Merinos or Rambouillets on which to make the cross. Such a procedure entails the keeping of two separate ewe bands, one of straight fine-wool breeding and one of crossbreds. If the grower keeps only crossbreds and wishes to produce his own breeding ewes, he may mate a portion of them with crossbred rams, or with purebred rams of a breed carrying essentially

the same kind of wool as that produced by the crossbreds. The Corriedale or the Romeldale may be recommended for this purpose. The use of crossbred rams is not generally to be recommended, although good results may be had if the rams have been produced by interbreeding and rigid selection over several generations. Breeding a portion of the crossbred ewes back to fine-wool rams or to long-wool rams produces offspring

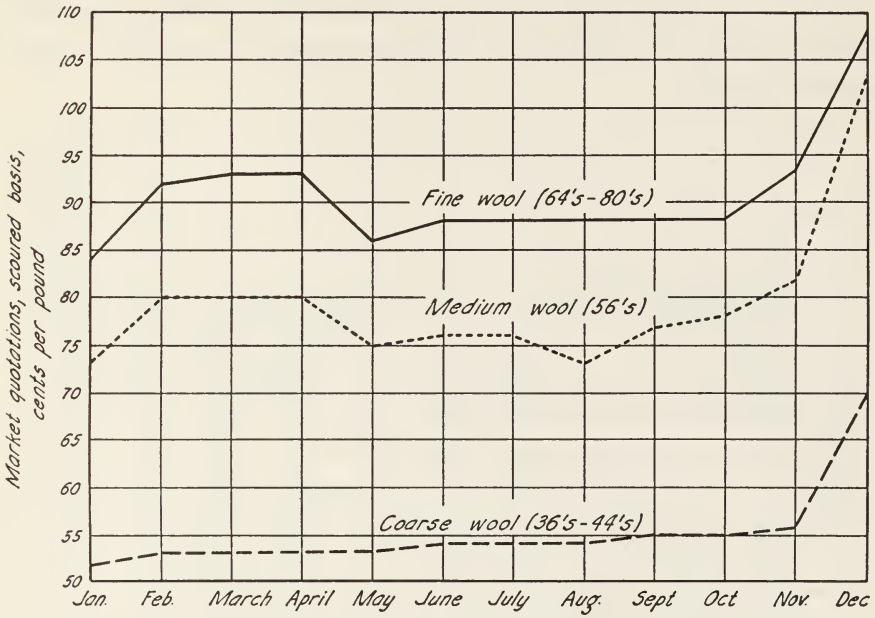

Fig. 4.—The influence of grade or diameter of fiber on the price of wool.

with fleeces a grade finer or a grade coarser than the parent crossbred. There is a disadvantage in having the wool clip representative of many grades. In some sections of California, however, crossbred ewes carrying 75 per cent of fine-wool blood and 25 per cent of long-wool blood are popular. Their fleece usually grades 58/60's, or half-blood, of very satisfactory weight and of combing length.

FACTORS AFFECTING WOOL VALUES

GRADE

In general, the finer wool is, the greater its value when *scoured* or on a clean basis. Demand for various grades plays an important part in determining values, and the spread in prices between scoured fine wool and scoured medium or coarse wool fluctuates. Over any considerable period, however, scoured wool of any particular grade will have a higher average value than scoured wool of any coarser grade (fig. 4).

LENGTH OR CLASSIFICATION

The combing wools, suitable for manufacture into worsteds, are invariably of greater value on a clean basis than clothing wools of the same grade and of similar character. Within certain limits the longer wool is, the higher is its money value (fig. 5); but extreme length in the finer grades, resulting from growth of two years or more, may actually reduce the value because of the special treatment necessary in the mills to break up such fleeces.

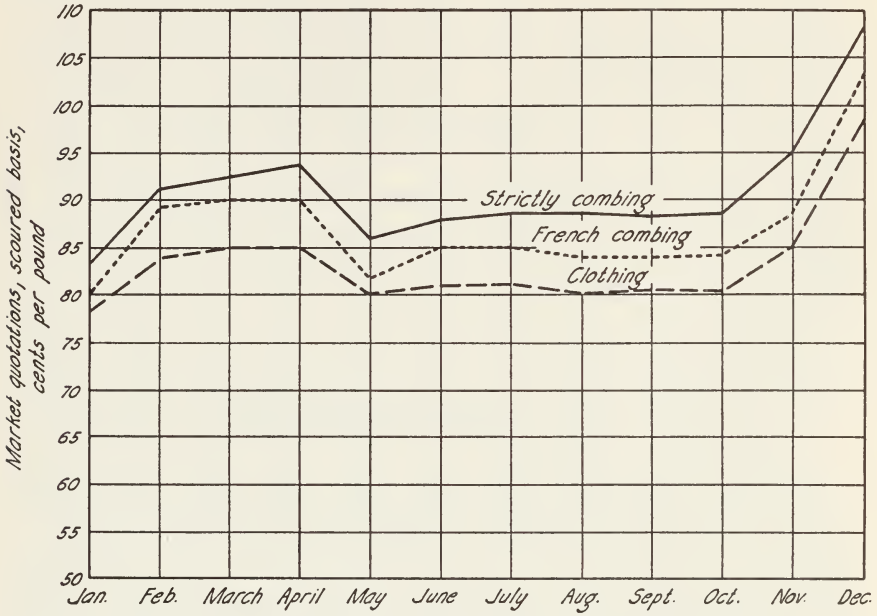

Fig. 5.—The influence of length of staple on the price of wool.

SHRINKAGE

The percentage of the weight of raw wool lost in scouring is called the "shrinkage." If 100 pounds of greasy wool weighs 38 pounds after scouring, it has lost 62 pounds; and the percentage of weight lost is 62 ÷ 100 or 62 per cent. The actual weight of clean wool produced is called the "yield." Expressed in percentage, the yield is 100 per cent minus the shrinkage. Thus if a certain lot shrinks 60 per cent, the yield is 40 per cent; if the shrinkage is 52 per cent, the yield is 48 per cent, etc.

Shrinkage is the most important and yet the most variable single factor affecting wool values. It varies not only with the breed of sheep but also with individuals of the same breed kept together in the same pasture throughout the entire growth period of the fleece. It is affected by cli-

matic conditions, by the types of soil over which the sheep are run, and by flock management. In California it ranges from about 28 per cent to as high as 80 per cent.

The Causes of Shrinkage.—The fleece as it comes from the sheep consists of a mass of wool fibers, each more or less covered with grease secreted by glands in the sheep's skin. Other and entirely different glands pour out perspiration which dries into *suint*. The grease and suint together constitute the *yolk*. Dirt gains access to the fleece either by being blown in by the wind or by touching the fleece when the sheep lies down. The dirt adheres to the grease. Moisture is also present. Vegetable matter, such as seeds, burs, and straw, is sometimes found, especially in certain California valley wools. The fleece, then, is made up of wool fibers, wool grease, dried perspiration, dirt, moisture, and vegetable matter. Of these, the wool manufacturer can use only the actual fiber and a normal amount of moisture. Buyers, therefore, always estimate the percentage of shrinkage in order to judge how much wool fiber will be left for manufacturing textiles.

Most fine wools grown in the United States shrink at least 60 per cent. On the other hand 50 per cent is a high shrinkage for low-quarter-blood or braid wools grown under identical conditions. In the central Sacramento Valley the fine spring wools coming mostly from sheep of Merino and Rambouillet extraction shrink about 60 to 64 per cent, while the medium wools coming from flocks carrying a predominance of Shropshire or Hampshire blood shrink about 50 per cent. This difference is due to grade and depends largely upon the breed of sheep from which the wool is taken.

Effect of Individuality.—The influence of individuality of the sheep upon the shrinkage of wool was demonstrated in the University wool laboratory in a scouring test. The fleeces used were of exactly twelve months' growth, all shorn on the same day, and all from registered Rambouillet ewes that had been kept as one lot during the entire period of growth. The shrinkage on these fleeces varied from 61.4 per cent to 70.7 per cent—a difference that must be ascribed largely to individuality.

Effect of Climatic and Soil Conditions.—Fine combing wools grown in the north-coast counties usually shrink 50 to 60 per cent. Similar wools grown in the Red Bluff section of the northern Sacramento Valley usually shrink 58 per cent to 64 per cent. Fine wools grown in Kern or Fresno counties normally shrink 2 to 5 per cent more than similar wools from the Red Bluff area. These differences are due to varying climatic conditions. The north-coast counties have a comparatively high average rainfall, which tends to wash out part of the dirt and dried perspira-

tion. This factor accounts partly for the light shrinkage of the coast wools. The Sacramento and San Joaquin valleys have a lower annual rainfall; and, in addition, the soil over which the sheep are run is usually more sandy than that of the north-coast counties.

Effect of Care and Management of Sheep.—By so constructing hay-feeding racks that a minimum of seeds and chaff fall into the fleece, sheep owners who practice supplemental feeding will keep the shrinkage at a minimum and also render the clip more attractive and salable. Tagging the ewes before shearing will reduce the shrinkage and enhance the value of the wool. The soft dung that often adheres to the britch at the time of spring shearing is particularly objectionable because, if rolled up with the fleece, it not only increases the shrinkage but also damages the wool by permanently staining those portions of the fleece with which it comes in contact.

Affect of Sex of Sheep.—Ram fleeces usually shrink from 2 to 4 per cent more than ewe fleeces of the same breed. This is especially true among fine-wool sheep. Rams often secrete more yolk in the wool than do the ewes.

Undesirability of Heavy Shrinkage.—Heavy-shrinking wool is undesirable, being much less attractive to a prospective buyer than similar wools with a lighter shrink. It is also more difficult to scour, and the scouring operation requires more soap, more soda ash, and more time than with light-shrinking wools of the same grade. The wool fiber should have sufficient grease to protect the fiber properly from damage by the elements. It is possible—at least in some climates—to develop by selection wools so light in grease content that the fiber may be made harsh and dry by weathering. Nevertheless many breeding sheep—particularly fine-wool sheep—carry in their fleeces far more grease than is necessary for adequate fiber protection. In selecting fine-wool rams for flock development the breeder should prefer animals carrying only a moderate amount of grease.

Light-shrinking wools may be shipped more economically than heavy wools, whose grease and dirt take the same freight rate as the actual fiber. To enjoy the benefits of light shrinkage, however, the grower must sell his clip at a price based on the grade, shrinkage, and character of his wool. If buyers pay a flat rate per pound for all wool in an entire community, light shrinkage is hardly an advantage.

A fleece that is heavy when it comes off the sheep does not necessarily contain a large amount of real wool. At the University of California wool laboratory, two Rambouillet fleeces were scoured whose grease weights were 18.2 and 13.9 pounds respectively. The lighter fleece of the

two yielded 5.33 pounds of scoured wool; the heavier 5.36. In the grease the 13.9-pound fleece contained less yolk than the heavier one, was brighter and more attractive in general, would have found more favor with the buyer, and was actually worth more money.

Arithmetical Problems Involving Shrinkage.—In solving these problems it is assumed that the wools are well grown and properly prepared for market. Although the definitions of shrinkage and yield have already been given, it is necessary to understand clearly the meaning of the terms scoured basis (or clean basis), and scoured.

Scoured basis refers to the value or weight of wool when the grease, dirt, and other factors responsible for shrinkage are removed. It does *not* include the cost of sorting and scouring. As an example let us say that California middle counties wool is quoted in the market report at 80 cents scoured basis, or 80 cents clean. This is the clean price charged by the dealer in graded grease wools to the manufacturer. The manufacturer buys the wool on a shrinkage basis, paying a grease price estimated to make the wool cost him 80 cents a pound *plus* the cost of sorting and scouring.

An example may clarify the distinction between "scoured basis" and "scoured." In a 1937 market report "California northern" wool was quoted at 78 to 80 cents "scoured basis" while "fine scoured" was also quoted at 78 to 80 cents. California Northern is fine wool of combing length; and this wool graded was worth 78 to 80 cents in Boston, plus the cost of sorting and scouring after it reached the mill. "Fine scoured" on the other hand, has been actually sorted and scoured on the Pacific Coast before being offered for sale. It is very short, fine, clothing wool of a type unprofitable to ship East in the grease. If the fine, heavy-shrinking, short, clothing wool were quoted on a scoured basis, its price would be several cents less than the price of California northern.

In some sections of the United States the shrinkage of any particular grade is so uniform that market quotations are made on a grease basis, but in all the western states shrinkage is so variable that quotations in the grease would be impractical.

There are only two simple rules to memorize for calculating wool values. These are:

Rule 1. 100 per cent – shrinkage = yield.

Rule 2. Yield × scoured basis value = grease value *at the mill.*

Problem 1. California northern counties wool is quoted at 84 cents a pound, scoured basis, in Boston. A certain lot of this wool is estimated to shrink 60 per cent. What is the grease value of the wool in Boston?

Solution:

Applying rule 1,

100 per cent – 60 per cent (shrinkage) = 40 per cent (yield).

Applying rule 2,

40 per cent of 84 cents (scoured basis value), or 0.40×84 cents = 33.6 cents (value in Boston).

How to Get the Ranch Value.—Wool-market quotations represent prices at or near the mills, most of which are located on the Atlantic seaboard. Boston is the leading wool market, and quotations are generally considered as Boston values. The grower must deduct from the calculated price in Boston an amount sufficient to pay the freight to that city and also the charges for insurance, cartage, and brokerage. The total of such charges (including freight) is about 4 cents a pound. The grease value at the ranch of the wool described in Problem 1 is therefore 33.6 cents – 4 cents or 29.6 cents a pound.

Problem 2. A grower is offered 30 cents a pound, f.o.b. ranch, for his clip. The clip is practically all one grade, and its shrinkage is estimated at 58 per cent. How much will this clip cost "clean-landed Boston"?

Solution:

Add the charges for freight and handling: 30 cents + 4 cents = 34 cents (grease cost in Boston).

Applying rule 1,

100 per cent – 58 per cent (shrinkage) = 42 per cent (yield).

Therefore 34 cents = 42 per cent of clean cost; and 1 per cent of clean cost = $\frac{1}{42} \times 34$ cents, or 8.095 cents.

100 per cent of clean cost = 8.095 cents $\times$ 100 = 80.85 cents, or, in round numbers, 81 cents a pound.

The importance of shrinkage as a factor affecting wool values may perhaps be best illustrated by the following rule: Every per cent of increase in shrinkage decreases the actual grease value by 1 per cent of the scoured-basis value. If, for example, fine combing is $1.00 a pound, scoured basis, every per cent of increase in the shrinkage reduces the grease value on the ranch 1 cent a pound; if the price is 88 cents, the reduction is 0.88 of a cent, etc.

Most growers are unable to sell their clips on the ranch at a price that represents the calculated grease value at the mill minus the charges for transporting the clip to the mill. Market quotations are necessarily based upon graded wools, and when the grower's clip is ready to leave his hands it has not been graded. Although some clips, especially those from well-bred flocks, may run so predominantly to one grade as to make grading

unwarranted, most clips contain at least two grades and usually more, besides occasional fleeces that will be "rejects." The buyer, therefore, must consider this fact and must estimate conservatively just how the clip will grade out.

Wool handled by a coöperative agency may be graded before being sold for the grower. In such an event, each grade is sold separately, and the price that the grower receives for his entire clip will be the mean of the prices received for the various grades sold. But if the wool is graded before selling, the grower cannot normally expect his fine combing, for example, to net a price calculated on market quotations minus transportation, because an additional charge must be made for weighing, receiving, grading, storage, and overhead at the coöperative warehouse.

Wool prices published in official market reports represent the prices for graded wools charged to manufacturers by dealers.

Shrinkage Tests.—The University annually receives many requests from wool growers who wish to submit samples of wool for scouring tests. Most of these requests are actuated by the grower's desire to ascertain the shrinkage of his clip in order to deal advantageously with the wool merchant. An accurate shrinkage test is of inestimable value to a wool grower and in many cases has enabled him to receive a price that he could not otherwise obtain. The test must be properly interpreted and should serve only as a guide to approximate values. It is not an infallible index to values, because : samples truly representative of the clip are very difficult to draw, even for persons trained in the work ; furthermore, any shrinkage figure obtained, however accurate, applies only to the current year in which the test is run ; and finally, shrinkage is only one factor affecting wool values. A scouring test reveals nothing of the grade, strength, or character of the clip. Demand for certain grades, style trends, and other influences also directly affect values.

CHARACTER

The crimp of the wool fiber, or its waviness, the general attractiveness of the fleece, its brightness and softness to touch are the chief attributes to its character. Generally speaking, character is responsible for the spread in prices for any one grade. As an example, fine combing wool may be quoted at 87 to 90 cents, clean basis. Wools of that particular grade somewhat lacking in character would be worth 87 cents clean basis, whereas those of better character would be worth 90 cents, clean basis.

PURITY

"Purity" denotes the absence of hair, kemp, and black or gray wool fibers.

Although very objectionable, hair is usually found on the folds or wrinkles of fine-wool sheep. Kemp is worse than hair because it has very little elasticity or strength and because, under ordinary methods of wool manufacture, it does not dye the same shade as normal fibers.

Pigmented fibers such as brown, gray, or black are common among the blackface breeds and occur occasionally among most others. Since the color cannot be economically bleached out, wool containing it must be used for making goods that are black or very dark. A fleece containing only a small percentage of dark fibers scattered throughout the fleece is just as objectionable as one entirely black, for both fleeces must be used for similar purposes and must be dyed dark enough to hide the naturally dark fibers.

A small quantity of naturally black wool is used in making garments for religious purposes. Such wool is not dyed. The amount so used, however, is very small; and most black or gray wool is discounted in value.

SOUNDNESS OR STRENGTH

The strength of any article made from wool depends upon the strength of the individual fibers. There is a great difference in the strength of wools of any particular grade. Strength or weakness of the fiber varies directly with the physical thrift of the sheep during the period of growth of the wool. If the sheep are poorly nourished during much of the year, the wool fiber may be weak throughout most of its length. Such a condition may be caused by old age of the sheep and by factors other than an actual lack of feed. Overfeeding, underfeeding, or sickness may develop a weakness in the wool fiber so pronounced that the animal may cast its fleece; that is, the wool drops off. If the weakness is less pronounced, the weak spot may be pushed out farther and farther from the skin as the wool grows until when the sheep is shorn it may be at any point along the length of the fiber, according to the time at which the weakness developed in relation to the time the sheep was shorn. Such wool is said to be tender or to have a "break." Figure 6 shows a marked break in the staple.

The grader tests every fleece for soundness. All tender fleeces that would have been classified as combing or French combing if they had been well grown are put into the clothing wools, because the weak fiber cannot stand the strain imposed upon it by the combing process.

A common cause of tender wool is allowing the ewes to become very thin during part of the year and then putting them on good feed that will cause them to fleshen rapidly. Tender wool will also be found among ewes that for one cause or another have developed fever. Tender fleeces cannot be wholly eliminated even under expert management. Occasionally a ewe may have trouble in lambing, develop a fever, and produce a

Fig. 6.—Tender wool. The "break" is shown as a distinct line running across the staple about one-third of the distance up from the proximal end. (Sample, courtesy of the Northern California Wool Warehouse Company.)

tender fleece as a result. Other sheep may have ulcerated teeth, tongues or jaws ulcerated from foxtail, pneumonia, or any one of a host of other troubles that may cause a marked physiological disturbance and thus make the fleece tender. The most common cause of tenderness, however, is of nutritional origin, arising directly from poor feeding practices. Tenderness from this cause can be minimized by judicious feeding and intelligent range management.

STAINED WOOL

Sheep housed in barns or sheds or confined in corrals often have portions of their fleeces stained from lying in manure or in urine-soaked bedding. The stained wool is usually to be found on the sides and thighs. A small quantity is produced on the britch of practically every ewe. When sheep are not tagged before being shorn and when dung locks adhering to the

britch are packed in the center of the fleece at shearing time, the wool that comes in contact with such locks is liable to become stained.

Wool stained by manure or urine cannot be scoured white and must therefore be removed by the wool sorter before scouring. Stained wool can be used only for making dark-colored materials and consequently sells at a discount. So important to the manufacturer is the problem of eliminating stained wool that, in some commercial scouring plants, at least one operator is stationed at the outlet to each mechanical wool dryer to pick out from the scoured wool any stained pieces that the sorter may have overlooked.

The term "sack burned" is used to describe wools that have assumed a livid yellow color from having been packed too moist. It is often brought about by storing the moist wool in a warm place but may also occur before the wool has been shorn from the sheep. The change in color on the sheep is not widely prevalent in California. It is most often found in the north-coast counties among medium-wool and long-wool breeds. The change from white or cream to a decided yellow is in the fiber itself, not in the yolk. Such wool is permanently damaged. It loses its softness and becomes harsh and wiry. Since the yellow color cannot be removed, the wool must be treated as stained. The livid yellow is often called "canary color." It is thought to be caused by bacterial action. In Tennessee, Virginia, Kentucky, and West Virginia, lambs' wool at times during summer weather is often badly damaged by this stain. The color is also common among show sheep of the medium and long-wool breeds that are carrying fleeces greatly in excess of twelve months' growth.

In the north-coastal area of California where the rainfall is heavy, fleeces are sometimes streaked on the back and sides with pink, red, green, and brown. The California Experiment Station has shown these discolorations to be of bacterial origin. Possibly the entire range of these colors is caused by the same organism. The stain is not permanent and can be readily removed by scouring. In any flock to which the bacterium gains access, only a few individuals are affected.

CONDITION

As applied to grease wool, "condition" refers to the amount of foreign matter present, exclusive of vegetable matter. A wool with a high shrinkage, especially one with a high grease content, is said to be "heavy conditioned."

White, light buff, or cream-colored fleeces are more popular with buyers than dark fleeces, although the latter will usually scour out equally well.

Color Not an Index of Grease Content.—Many growers think that a dark yolk indicates a high grease content. In reality, however, the color is caused, not by the grease itself, but by a wholly unrelated pigment. Many Merino fleeces that appear almost snow white have a very high grease content; many dark-appearing Rambouillet fleeces carry little grease. The chief advantage of a very light-colored fleece would seem to lie in its greater attractiveness.

"HOW MUCH IS WOOL WORTH?"

This question is often asked. As shown by the discussion of the factors affecting wool value, it cannot be intelligently asked or answered. The value of wool depends on many factors. To ask "How much is wool worth?" is like asking how much buildings are worth or how much land is worth.

WOOL GRADING AND WOOL SORTING

Grading.—The bag of wool to be graded is opened at the ends and down the seam that runs the full length of the bag. The grader examines each fleece individually without untying it and notes first its fineness or diameter of fiber. He removes a lock of wool from the fleece by grasping it at the tip or "weather end." This operation is called "stapling." Holding the lock between the thumb and forefinger, the grader measures the length by turning the staple back over the thumb and noting how nearly it approaches the joint. Obviously some fleeces are so short or so long as to make this operation unnecessary. Having determined whether the fleece classifies as combing, French combing, or clothing, according to the length of staple, he next tests it for strength and soundness by pulling it. Turning the fleece over, he withdraws a second lock and makes the same tests. After examining two or more such representative locks, he throws the fleece into the basket or bin in which only fleeces of that particular grade and classification are placed. Many fleeces—particularly the short clothing wools—are not stapled because their length is obvious and because strength tests on clothing wools are less important than on combing wools.

Tender wools are put into the clothing wools, regardless of length. Black fleeces, gray fleeces, and fleeces that exhibit only a few black fibers throughout the main part are discriminated against and placed in separate containers. Fleeces in which the fineness of fiber varies widely in different parts may be "thrown down"; that is, they may be placed one or two grades lower than their finer parts indicate. Occasionally a fleece of one grade may be thrown a grade higher because of exceptional char-

acter, light shrinkage, and good length. Line fleeces are those on the dividing line between two grades. Such fleeces may be thrown into either grade, according to market demands and expediency.

Shrinkage also is often considered in wool grading. When a large quantity is graded, the warehouse management may decide to have two or three kinds of wool of any one grade, the difference between them

Fig. 7.—Graded wools on display in Boston. (Courtesy of the National Wool Marketing Corporation.)

being largely one of shrinkage. Thus the No. 1 fine combing may have light shrinkage; the No. 2, medium shrinkage; and the No. 3, heavy shrinkage.

At times special demands may warrant the separation of exceptionally long-stapled fleeces from those that barely meet the description of a strictly combing wool.

Burry and seedy (defective) wool is never put with wool that is free from vegetable matter.

As the containers for each grade are filled, the wool is wheeled or trucked away to be neatly piled up on the floor of the warehouse. Figure 7 shows how graded wools are piled for display. Each pile contains wool of one grade only and of similar shrinkage. Since the size of the piles is not limited, large warehouses sometimes have as much as 50,000 pounds or more in one pile. It is from these piles that sales are made to manufacturers.

The grader must have attained, through long experience, an intimate knowledge of wool in order to fulfill properly the demands made upon

Fig. 8.—Wool grading. The grader is on the extreme right. (Courtesy of the American Woolen Company.)

him. He must know the fineness of fiber that determines each grade, the length necessary for each classification, and the fundamental principles of all the processes involved in making wool into cloth. Figure 8 shows a wool grader at work.

The wool buyer in the field and the manager of a coöperative wool-marketing agency should know all that the grader knows, and in addition must be able to estimate accurately the shrinkage of any clip and must know values and markets.

"Original Bag" Lots.—Nearly all complete wool-market reports during the period of most active selling will quote "original bag" wools at

Fig. 9.—"Original bag" wools on display in Boston. (Courtesy of the National Wool Marketing Corporation.)

certain prices. This term means that these clips are so uniform in grade and so large that it would not be economical to open the bags, remove the fleeces, grade, and pile them. Such clips are sent directly to mills, usually by the dealer, in the original bag in which the wool was placed at shearing time.

Sorting.—After purchasing a lot of graded wool from the dealer, the manufacturer must have each fleece undergo the "mill sort." Sorting consists of untying the fleece and separating it into its various qualities (fig. 10), a process not involved in grading. To illustrate the difference between grading and sorting, table 4 is presented.

In many mills the regular sorts are not called by the official grade nomenclature. Thus the half-blood combing may be called "XX," "3's," or some other name adopted for convenience in that particular mill.

Sorting must be done before the wool is scoured, the method varying with the kind of goods to be made. Since the dealer in whose warehouse the wool is graded does not often know in advance to whom the graded lots will be sold and since he does not know the kind of goods for which the wool will be used, the sorting and blending of most wool must be left to the manufacturer. Figure 10 shows sorters at work in a large American textile mill. The short, heavy clothing wools and the wools so infested with burs and seed that carbonizing is necessary, may be scoured

TABLE 4

COMPARISON OF THE RESULTS OF GRADING AND OF SORTING WOOL

Results of grading 5 bags of wool from a grade Merino flock		Results of sorting a bag of graded 58/60's strictly combing wool	
Grade	Amount	Sort	Amount
	pounds	Regular sorts:	*pounds*
64's-80's (fine) strictly combing	130	58's-60's (½ blood) combing	144
64's-80's (fine) French combing	472	58's-60's (½ blood) French combing	60
64's-80's (fine) clothing	234	58's-60's (½ blood) clothing	22
58's-60's (½ blood) strictly combing	458	56's (⅜ blood) combing	5
58's-60's (½ blood) French combing	208	Off sorts:	
58's-60's (½ blood) clothing	60	Tar (paint clips)	1
56's (⅜ blood) strictly combing	28	Black-gray	2
		Fribs	3
Total from five bags	1,590	Stain	13
		Shorts	1
		Tender	2
		String	2
		Total from one bag	255

before being sold to the mill. California produces large quantities of such wool and consequently has several wool-scouring plants. In these plants most of the fall wools produced in the interior valleys and some defective spring wools are scoured, carbonized, blended, and then offered for sale. California's spring clip, which is freer from seed, longer in staple, and better in character than the fall clip, contains many fleeces of which only certain parts are defective. Dealers commonly open fleeces of this description, separating the "free" wool (free from burs) from the "defective" (burry). The free portions, especially those of combing length, are baled and shipped to the manufacturer in the grease, to be sorted and scoured at the mill, while the defective and off sorts are scoured and carbonized locally.

The Importance of Evenness of the Fleece to the Wool Grower and to the Manufacturer.—Manufacturers buy all wools for what they can get

out of them in textile products; and the buyers who purchase wool from growers to sell to these manufacturers must do likewise. A fleece uniform in fiber diameter and length is far more easily sorted than a fleece uneven in length and highly variable in fiber diameter over various parts of the body. Worsted manufacturers must sort each fleece not only for its various qualities but also for various lengths of staple. If the manu-

Fig. 10.—Wool sorting in the Wood Worsted Mills, Lawrence, Mass. (Courtesy of the American Woolen Co.)

facturer buys a lot of 58/60's or half-blood strictly combing wool, he is buying *graded* wool, knowing that in every fleece portions must be removed which are not 58/60's combing. He hopes, however, for as large a proportion as possible of the "main sort." The coarser portions of the fleeces, if of combing length, may be saved for inclusion in another lot of similar wool; but all the off sorts and short portions must usually be resold to *woolen* mills. The example in table 5, taken from actual records in a worsted mill, illustrates the difference in cost to the manufacturer between two lots of wool, one taken from well-bred sheep and properly prepared, the other a less desirable lot. Although these wools were purchased during a period of prices that do not prevail today, similar results would obtain at any price level.

Many wool growers believe that if one clip is worth a certain price, any other clip in the same locality from sheep of similar breeding should be worth the same. Table 5 shows the fallacy of this belief. The wool in the well-prepared lot was bought at 2 cents a pound above the price paid for

TABLE 5

ADVANTAGES TO THE MANUFACTURER OF WELL-PREPARED AS COMPARED WITH POORLY PREPARED, UNEVEN WOOL

Sort	Well-prepared, well-grown, fine combing wool				Well-grown, fine combing wool, poorly prepared and uneven			
	Weight	Proportion of total weight	Value per pound	Total value	Weight	Proportion of total weight	Value per pound	Total value
	pounds	*per cent*	*cents*	*dollars*	*pounds*	*per cent*	*cents*	*dollars*
Fine combing	186.50	77.40	—*	——*	128.00	45.07	—*	——*
Half blood and low combing	10.00	4.15	35	3.50	79.00	27.81	35	27.65
Fine clothing	35.00	14.52	28	9.80	55.00	19.36	28	15.40
Paint clips	0.87	0.36	8	0.07	0.00	0.00	..	.....
String	1.06	0.44	0	0.00	3.00	1.06	0	0.00
Fribs	0.50	0.21	12	0.06	3.00	1.06	12	0.36
Shivy (seedy)	2.25	0.93	20	0.45	0.00	0.00	..	.....
Stained	0.00	0.00	..	.....	2.50	0.88	25	0.63
Dung	0.00	0.00	..	.....	6.00	2.11	0	0.00
Shinlocks and britch	0.75†	0 29†	17†	0.13†	5.00	1.76	17	0.85
Air loss	4.07	1.69	0	0.00	2.50	0.88	0	0.00
Total	241.00	99.99		14.01	284.00	99.99		44.89

Calculation of cost of fine combing wool actually obtained

	Well-prepared wool	Poorly prepared wool
Net weight of bag of wool purchased, pounds	241	284
Purchase price of wool, cents per pound	35	33
Cost of bag of wool, dollars	84.35	93.72
Value of all sorts except fine combing, dollars	14.01	44.89
Net cost of total weight of fine combing, dollars	70.34	48.83
Weight of fine combing, pounds	186.50	128.00
Cost per pound of fine combing, cents	37.7	38.1
Net cost of fine combing, above purchase price, cents	2.7	5.1

* See calculations in lower part of table.

† Shinlocks only, no britch.

a similar lot poorly prepared; yet the net cost per pound to the manufacturer was about ½ cent a pound less.

The argument is often advanced that shipping grease wool from the western states to the eastern seaboard for manufacture involves an unnecessary financial loss to the grower, who in the end must pay the freight on the grease and dirt in the wool. The lower value of California

fall wools and defective, short spring wools, as compared with wools of combing length suitable for worsted manufacture, justify their being scoured before shipment. To scour the free spring wools and the twelve-months' clip from California's northern counties, however, would be impracticable. Many manufacturers of high-grade worsteds not only do their own sorting and blending, but for certain reasons want to scour their own wool or to have it scoured under their direction. Most top makers, who supply top (see Glossary) to those manufacturers not equipped to do their own preliminary processing, also find it advantageous to do their own sorting. It is problematical, therefore, whether greasy shorn wools of combing length will ever be sorted and scoured near the place of origin unless the mills move to the Far West.

SCOURING WOOL AT HOME

Scouring and carding wool by hand in the home is a tedious process. Machine-carded batts are superior to those carded by hand from the same wool. Since, however, many growers' wives wish to use home-grown wool in their own comforters, the following directions, evolved from experience in hand-scouring wool in the University of California wool laboratory, are offered as a guide.

Materials needed:

Three or four ordinary wash tubs of medium or large size
Hot water
Neutral soap and a kettle for dissolving it
Sal soda
Wringer
Wooden paddle
Fahrenheit thermometer if available

1. Select fleeces of medium grade, preferably of seven months' growth, and free or nearly free of vegetable matter.

2. Untie the fleece; spread it out on the floor or on a large table; remove the stained portions, tags, dunglocks, shanks, and any other undesirable portions.

3. Break the fleece up into small portions. The more it is torn apart or shredded, the better the scouring liquors will penetrate.

4. Use galvanized-iron wash tubs of medium or small size. It is best to have three for the actual scouring and another for rinsing, although it is possible to use only three tubs and rinse all the wool at one time after scouring is completed.

5. Place about 7 gallons of water, preferably rain water, in each tub.

The temperature of the water in each tub should be about 115° to 120° Fahrenheit, or just as hot as the hand can bear.

6. Dissolve 3 heaping tablespoons of sal soda (also called sodium carbonate, or soda ash) in each tub except the rinse.

7. Dissolve about 1 pound of neutral soap, such as Lux or Ivory soap flakes, in hot water. Do *not* use ordinary laundry soap or washing-machine soap; for these will make the wool harsh and therefore difficult to card. The addition of the right quantity of soap to each tub is one of the most difficult tasks in home wool scouring. The amount to be added depends on the kind of wool being scoured and upon the softness of the water. The proper amount can be determined by trial only. Add about 2 teacups of the soap solution to the first tub, and stir it with the wooden paddle. Then take one handful of wool, immerse it in the tub, remove it, and pass it through the wringer. Watch the soap bubbles form on the wringer rolls. When the bubbles appear freely but disappear quickly, the amount of soap is about right. Keep repeating this test with a fresh handful of wool, adding small amounts of soap to the tub until this effect is obtained. Remember that too little soap will fail to clean the wool; too much will cause the wool to felt, so that subsequent carding will be very difficult. The second and third tubs require a little less soap than the first.

8. When the scouring liquor has been prepared and tested, the work is ready to proceed. Take about 1 pound of wool at a time, immerse it in the first tub, and stir it very gently with the wooden paddle. Keep this up for about 4 minutes. Then remove the wool, pass it through the wringer, and put it into the second tub. Repeat the operation and put it into the third tub. After about 4 minutes of gentle stirring in the third tub the wool should again be put through the wringer and is then ready to be rinsed.

9. For best results, do not try to scour more than a pound of wool at a time.

10. If the temperature of the scouring bath gets below 115° F, the solution should be heated up.

11. When three tubs containing soap solution are used, there is no need to worry over how dirty the first tub may appear. Experiments at the University wool laboratory have shown that at least 20 samples may be passed through a battery of three scouring tubs and a rinse before the results are affected. The main thing is to watch the quantity of soap and add a little from time to time as needed to make bubbles appear on the wringer rolls.

12. After a rinse in clear water, preferably lukewarm, the wool may be spread on a sheet to dry in the sun. It should be spread out in a thin layer and rearranged every couple of hours in order to dry quickly.

A piece of window screening or ⅛-inch mesh hardware cloth will be found a big help in getting the wool out of the tubs. Take a piece about 6 inches square and use it as if it were a sieve.

The weight of the wool batt for a comforter varies from 2 to 4 pounds; 3 pounds is very satisfactory. Since there is no waste in hand-carding, a 3-pound batt requires 3 pounds of scoured wool, which may usually be obtained from one spring-shorn fleece with most kinds of sheep.

Hand cards may be obtained from the California Wool Growers' Association, 595 Mission Street, San Francisco.

PREPARING WOOL FOR MARKET

CARE OF THE SHEEP BEFORE SHEARING

To produce a clip that is properly prepared for market the grower must have, first of all, a flock whose fleeces make good preparation possible. An admixture of several breeds, resulting in widely divergent grades and lengths of wool, does not lend toward an attractive clip.

Preparation for market should begin immediately after the previous shearing; for preparation consists of caring for the fleece during its growth period as well as placing it in the wool bag.

Feeding.—Improperly nourished sheep produce light, frowzy fleeces unattractive to buyers.

An experiment to determine the effects of nutrition on wool production was conducted at the California Agricultural Experiment Station. Three Romney wethers were fed in dry lot a ration of alfalfa hay and rolled barley in an amount sufficient to cause them gradually to gain in weight over a period of six months. The resulting fleeces were compared with others from the same sheep grown during the corresponding six months of the following year on a ration that caused a gradual loss in body weight. At the end of the latter period the wethers were all in good health and were no thinner than are thousands of ewes in California and elsewhere at the time their lambs are weaned. The average weight of the fleeces produced during six months on the good ration was 8.62 pounds; on the poor ration 2.51 pounds. The former fleeces averaged 4.3 inches in staple length; the latter 2.5 inches. Great differences were found in the loftiness, handling qualities, strength, and crimp of the fleeces, each of which attributes was enhanced by good feeding. Figures 11 and 12 depict some of the more readily observable differences. The results secured in this experiment have been generally verified by others. In each

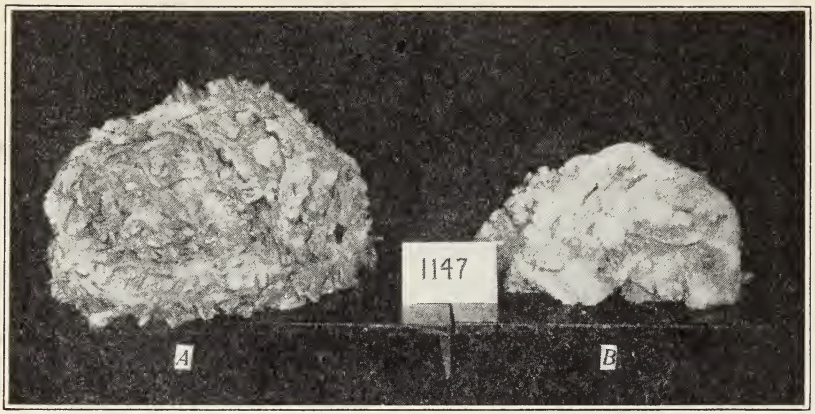

Fig. 11.—The influence of nutrition on wool growth and character. Each of the fleeces shown above represents six months' growth on the same Romney wether. *A*, effect of supermaintenance ration; *B*, effect of submaintenance ration. In addition to substantially greater fleece weights, the good ration gave fleeces that were longer, stronger, loftier, and better crimped.

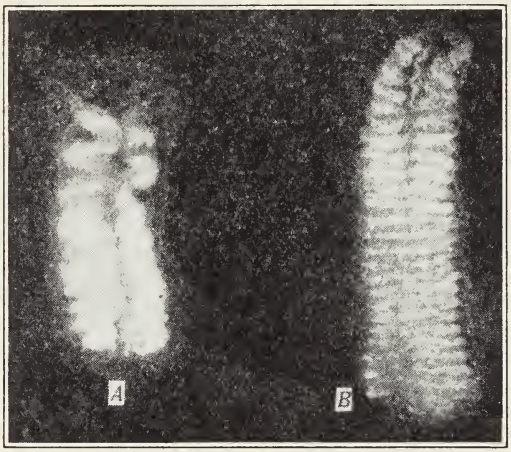

Fig. 12.—The influence of nutrition on wool growth and character. Each of these samples represents six months' growth on the same spot on the same shoulder of the same Romney wether. *A*, effect of submaintenance ration; *B*, effect of supermaintenance ration.

case good feeding was rewarded by increased wool production. Any ration that will keep the animal thrifty, as evidenced by its body weight and condition, will produce an optimum quantity of wool. The sheep need not be maintained in high condition.

In California, sheep may be subjected to very adverse conditions during December, January, and February. In the central valleys most of

the lambs are dropped during that time; and the natural feed available, although green, is washy and lacking in feed value. Thus the ewes that have dropped lambs must nourish their offspring at the very time when available nutrients in the natural feeds are at a minimum. Obviously supplemental feeding to keep up the body weight of the ewe and consequently to allow her to produce a normal milk flow while growing a normal fleece is advisable. The difference between the fleece weights obtained from a satisfactory plane of nutrition as compared with an unsatisfactory one may pay a large portion of the cost of reasonable supplementary feeding over the critical period. With alfalfa hay at $10.00 a ton and with an allowance of 3 pounds a head daily in addition to pasture, the cost of the hay for 2½ months would be $1.13 a head. In addition to producing a heavier fleece, a well-nourished ewe will raise a heavier lamb and is more resistant to disease and the effects of parasites than an undernourished one.

Branding.—If the sheep are kept under conditions that make paint branding unnecessary or optional, they should not be branded at all. Where paint branding is considered advisable, brands only large enough to be distinct should be used. The sheep should be branded in one place, preferably on the back. The more branding fluid used, the more wool must be put into the off sorts by the sorter.

Sheep-marking fluid or other branding materials manufactured and sold especially for the purpose are the only substances recommended. Experiments on branding substances conducted at the California Station over a period of several years indicate that no liquid now sold is completely satisfactory to grower and manufacturer alike. The tests showed that those substances which would last throughout a year on the sheep's back were insoluble in scouring, whereas those which were readily removed in scouring did not wear well. Marked differences were observed in the lasting qualities of certain substances under widely divergent climatic conditions. The brands deteriorated far more rapidly in the intense sunlight of the Sacramento Valley than in the humid and foggy areas of the north coast.

Tagging the Ewes.—Many California wool growers tag the ewes before the lambing season, shearing off closely the wool on the udder and around the external genital organs. This practice not only enables the lambs to nurse better but prevents the collection of heavy dung locks, which on untagged ewes adhere to the buttocks when washy green pasture is being used in the winter and early spring months. Tagging is a reasonably efficient preventive against strike from blowflies.

SHEARING

Shearing should always be done in a clean place. Most of the larger range flocks in California are shorn in sheds designed for the purpose; but many farm flocks are shorn in barns or sheds, often on dirt floors, where straw and chaff are mixed with the fleeces. A board floor is preferable to any other and at intervals during shearing should be swept clean. The more modern shearing sheds are provided with holding pens and catch pens having slatted floors. Such a floor, constructed usually of $\frac{7}{8} \times 1\frac{1}{4}$-inch slats set on edge, permits the droppings from the sheep to fall between the slats to the dirt floor below. A secure footing for the sheep is provided, in addition to greater cleanliness and increased ventilation.

Practically all sheep in California are machine shorn. Most wool growers do not own the shearing equipment. Many portable electric shearing outfits, consisting of a dynamo with direct connection to a gas engine, are being operated to drive individual fractional horsepower motors, which in turn motivate the individual shearing heads or hand pieces.

There is practically no difference in the amount of wool secured by machine shearing and by blade shearing. On most types of sheep the machine is faster than the blade, so that the work can be done in less time or with a smaller crew.

Second Cuts.—When the shearer must go over the same part of the sheep twice in order to cut the wool close to the skin, he cuts the staple in two. The short fibers shorn at the second stroke are called second cuts. Obviously these are almost worthless for worsted manufacture. The value of the fleece is reduced, too, because the average staple is shorter than if the full length had been obtained with one cut. Furthermore, the second cuts in worsted manufacture are combed out and become noils. The shearer cannot be expected wholly to avoid second cuts, especially when shearing heavily wrinkled fine-wool sheep; but he should be encouraged to eliminate them as much as possible. The extent to which both machine and blade shearers make second cuts depends partly on the type of sheep being shorn, but mostly on the skill of the individual shearer and the management of the shearing shed.

TYING AND PACKING

Tying the Fleece.—Only twine made from paper expressly for the purpose can be recommended for fleece tying. Other twines made of vegetable material, such as sack-sewing twine and sisal twine, are not smooth-surfaced; small fibers from them become mixed with the wool

when the fleece is untied. Wool is an animal product; twines are usually vegetable products. The two types require different processes of dyeing. When cloth is made from wool containing vegetable fibers, subsequent dyeing fails to color the vegetable portion. So serious is this question that most mills employ operators to extract the undyed vegetable fibers from the woven cloth and to insert in their stead, with a threaded needle, lengths of wool yarn. Figure 13 illustrates how cloth may be ruined by sisal or binder twine used for tying fleeces.

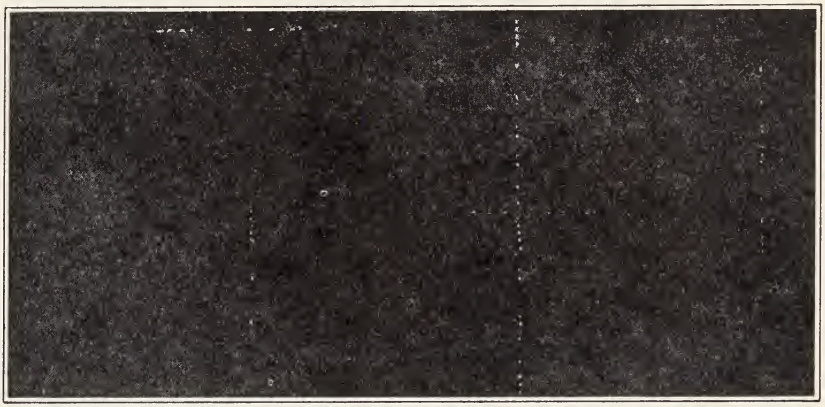

Fig. 13.—Damage to cloth from tying fleeces with sisal, or binder twine. The light-colored streaks show how sisal fibers, having become disengaged from the twine, become mixed with the wool and are woven into the cloth.

Even the jute bags in which wool is packed often cause vegetable fibers to be mixed with the fleece. British manufacturers have made several experimental attempts to evolve a type of wool bag or bale that would remedy the trouble.

The fleece should be rolled or folded with the belly, britch, and shanks inside, leaving the shoulder and neck wool exposed, white side out. Tying should not be left to the shearer but should be done by a special employee retained by the grower to perform that service. Shearers, being employed on a piece basis, care little whether or not the fleece is attractively tied. A clip in which every fleece is properly rolled and tied will sell to much greater advantage than one carelessly put up. Heavy dung locks, sweat locks, and any very short, seedy bits that may fall from the fleece should be left out and put into the tags.

Packing the Bag.—Only new wool bags should be used. A clip packed in secondhand, repaired bags is very unattractive to a prospective purchaser. Even for small farm flocks it is unprofitable to use grain sacks or beet-pulp sacks.

Wool bags are sewn with a lock stitch; and workers unpacking them usually open the seam by pulling out the lock-stitched thread without cutting the bag. For this reason the bag should be packed with the seam

Fig. 14.—Properly and improperly packed bags of wool. The bag on the left is loosely packed in an old used bag; fleeces of all types including black wool are thrown together. The bag on the right is properly packed. (Courtesy of E. H. Tryon.)

out so that it is accessible. Red thread is to be preferred because any small piece of it mixed with the wool is more readily seen by the sorter.

Lambs' wool, black fleeces, and cotted fleeces should be packed sep-

arately from the main clip. If their number does not warrant separate packing, they may be held out temporarily and later packed on top of the good wool. A folded grain sack within the wool bag may be used to separate these from the remainder of the clip.

Fleeces from Rambouillet and Merino rams should be packed separately. Fine-wool ram fleeces are nearly always more difficult to scour and have a somewhat higher shrinkage than the ewe fleeces. Many buyers insist on taking fine-wool "bucks" at a discount. Ram fleeces from the mutton breeds of sheep are often as valuable as the ewe fleeces and are usually not subject to discount. On the other hand, any exceptionally large fine-wool fleece that has a much higher shrinkage than the bulk of the clip and is otherwise unattractive may be called "bucks" by the wool grader whether or not it was actually produced by a ram.

For attractiveness and easy handling, the bags should be packed fairly tightly by tramping and should be smooth on all sides (fig. 14). A well-packed bag of fine wool weighs 250–325 pounds, largely according to the shrinkage. One of medium wool weighs 175–235 pounds. If the bag is not filled completely after the contents have been tramped in, the unused portion should be folded inside when the bag is sewed. Loosely packed bags are unattractive and are difficult to handle.

It is possible, however, to tramp some wools, especially fine wools, too tightly. Some growers try to see how few bags can be used in packing the clip. This practice causes the fleeces to harden and makes the clip unattractive when opened. It also makes grading and sorting more difficult. A bag of grease wool should be packed just firmly enough to allow maximum ease in handling.

WOOL MARKETING

Why the Grower Does Not Sell Directly to the Mill.—Very few textile mills purchase directly from the grower. There are several reasons. The chief one is that usually the mill wants to buy at one time more wool of certain grades than is contained in any one clip. For example, a manufacturer gets an order for cloth requiring 50,000 pounds of 58/60's or half-blood combing. If wool is purchased directly from growers, the mill may get the requisite quantity of half-blood combing; but because the grower's clip is not graded on the ranch before packing, the clips will contain fleeces of other grades, some offs, tender fleeces, and the like, which are not wanted. The manufacturer, therefore, wants graded wools; and since the wools are not graded by the grower, purchases must be made through some agency, dealer, or coöperative concern that performs that function.

Practically all individual mills are limited in the types of fabrics they make. They are either woolen mills, using short wools, or worsted mills using combing wools; seldom if ever does one mill make both woolens and worsteds. Even these two general types of mills are further limited as to the kinds of woolens and worsteds produced. Felt mills make only felt and can use only certain styles of graded wools for the purpose. Very often a woolen mill in which blankets are made produces little else. As the foregoing statements show, wool textile mills are highly specialized and must therefore exercise much care in purchasing raw materials.

Another reason why most mills do not buy direct from the grower is that most of the wools grown in the United States are sold at shearing time or shortly thereafter, whereas mills cannot or do not buy an entire year's supply of wool at one time. Someone, therefore, must provide the facilities for handling and storing the nation's clip between the time the grower sells it and the time the mill wants and can use it. Here again an agency, a dealer, or a coöperative must render service.

Why Wool Is Not Graded on the Ranch.—The average size of the clips produced in California does not justify their being graded on the ranch at shearing time. To do so would involve expense and equipment that could probably not be paid for through the increased selling price for the wool. In addition the grower would have on hand, as a result of grading, quantities of certain grades so small that they would be difficult to sell for their true value. The fact that in Australia, New Zealand, and elsewhere many clips are graded or "classed" at the point of origin is without parallel in California, where the clips are small. Some very large clips have been graded on the ranch in the United States; but the success of the operation has been so sporadic that the practice is not popular.

A few clips, especially larger ones from the Rocky Mountain area, may be of sufficient tonnage and uniformity of grade to warrant their sale to a mill as an "original bag" lot. Usually, however, such clips are sold to a dealer or consigned to a selling agency and do not pass directly from the grower's hands into the mill.

The influence of grade on wool values has been shown previously (p. 23), and the question naturally arises as to how the grower can best avail himself of any advantage that might accrue from selling graded wools. Because of lack of experience, he cannot grade his own clip. He may place himself in an advantageous position for intelligent selling, however, by so conducting his breeding operations that his clip will run as uniform in grade as possible. Mixed clips are difficult of evaluation by the buyer, who must always make conservative estimates. The grower of a large mixed clip, containing fleeces from two or three breeds or cross-

breeds, will find that separation of the various kinds of sheep at shearing time and separate sacking of their fleeces will enable him to find a more intelligent basis for determining values. Probably the only methods of disposal by which the grower can take advantage of price differentials for the various grades of wool are commission selling and coöperative marketing.

METHODS OF SELLING WOOL IN THE UNITED STATES

THE LOCAL BUYER

The local buyer may purchase wool on his own account for speculation or may serve as local representative of a wool merchant. He usually operates in one particular locality and purchases small clips that the growers desire to sell for cash. Often he is engaged in other business wholly unrelated to wool buying. When purchases are made for a wool merchant, the local buyer receives a commission based on the number of pounds secured. A knowledge of wool and wool values is not essential, since the merchant for whom the purchases are made establishes the prices to be paid. The price is set at a level that the merchant believes will net him a profit on the total tonnage bought by the local dealer; in other words, the local dealer will presumably buy as much or more wool with a value above the established price than will be bought with a value under that price. Thus local buyers in California tend to pay a flat price in each locality, although certain clips known individually to the merchant may sometimes bring prices differing from the average. Justification for the local buyer's existence lies in the handling of small farm clips. The merchant cannot travel about personally buying lots amounting to only a few bags each. The policy of merchants in setting "average" prices in each locality as a basis for local-dealer purchases causes some small clips to sell for more than they are worth, while others, the best ones, sell for less than their true value. Under such a system of marketing, the grower has no incentive to improve either the quality of his product or its preparation for market. Probably local buyers will continue to find employment unless some system is established whereby small growers in each locality can concentrate their clips at a central point for sale. Widespread adoption of coöperative marketing would likewise tend to eliminate the local dealer.

THE WOOL MERCHANT

The wool merchant handles most of the wool grown in the United States. He owns or rents warehouse space, buys large quantities of wool, grades it, and otherwise prepares it for use by the manufacturer. He has been

much criticized by growers who have felt that they were poorly paid. Some have suggested his elimination. They maintain that the merchant fails to differentiate sufficiently in prices between well-grown, properly prepared clips and poorly grown clips that show no care in preparation. They claim, furthermore, that prices do not represent the value as calculated from Boston scoured-basis values and shrinkage less handling charges.

The elimination of the wool merchant is undesirable, however, for he performs a real service to the industry. By paying cash he immediately assumes the risk of stagnant or declining market values during the time the wool is in his possession, which may be some months. Of course he cannot ascertain the amount of each grade present in the clip if growers throw all grades together when sacking the wool. He can only estimate the proportion of the various grades, and his estimates are naturally conservative.

In many cases, undoubtedly, the wool merchant buying on his own account for speculation does not pay a sufficiently high premium to growers who carefully develop and prepare a good clip. He, like the grower, is in business to make money; and in buying wool as cheap as possible he is following the same business procedure that the grower follows in purchasing feedstuffs. Experience has shown that when a buyer offers a flattering price for an outstanding clip, many growers in the same locality assume that their own wools are worth fully as much. To obviate hard feelings, therefore, speculative buyers may attempt to get at one price all the wools in a certain locality, the price being as low as possible.

In recent years the market news service disseminated to growers by mail and radio has helped inform producers about market values. During the same period competition among wool merchants has become keener; and as a result of this and of "order buying," the merchants, as a group, are now offering prices more nearly in accord with actual values than at any previous time. A few California clips well known to the trade for their standardized style and good packaging often bring prices fully commensurate with the market prevailing at the time of sale.

ORDER BUYING

The past two or three years have brought a great increase in purchases by wool merchants "on order" from mills. Under this system the mill orders from the wool merchant a certain tonnage to be delivered at a future date, at a certain price on a clean basis. The merchant and his buyers then purchase the wools from the growers as cheaply as possible.

Merchants in California who buy on order are usually buying on a commission basis of about ¾ cent a pound, turning their purchases over to an eastern merchant who is buying on order from a mill. As an example of the operation of order buying in California, suppose that a worsted mill gives a Boston merchant an order for 50,000 pounds of fine and half-blood California northern to be delivered in 4 months at $1.00 a pound, clean basis. The Boston merchant gives the order to a California merchant, telling him to buy this quantity at not over 95 cents a pound clean landed Boston, shrinkage guaranteed. The California merchant is to be paid a commission on all he buys. Having thus eliminated market risk, the California merchant is willing to pay the grower a price in keeping with the value of the clip, within the limit set by the eastern concern. He is already sure of his profit in the form of a commission. The eastern dealer is likewise sure of his profit. It is unfortunate for western growers that the orders are usually passed through two middlemen instead of one or none, but the method is infinitely preferable from the growers' viewpoint to selling to a speculator. Obviously when order buying is general, speculators must pay equivalent prices or fail to secure wool. Whether this system will be as widespread in the future as at present will depend upon whether it satisfies mill owners.

THE MILL BUYER

The mill buyer operates exactly like a merchant buying on order except that he is directly employed by the mill. As a mill employee, not buying on commission, he may be more inclined to seek cheap wool for his employer than a merchant order buyer, although when both are operating in the field at one time, the mill buyer must pay as much as anyone else or go without wool. One mill buyer may represent several mills. For reasons already given, not many mills buy directly from growers; and the number of mill buyers is therefore limited.

SELLING ON COMMISSION

Some California wool growers still sell on commission, although this method is not popular. In California the leading firms that sell the growers' clips on commission are also wool merchants. Many growers, however, object to consigning wool to a house that also buys wool on its own account. Under this plan the producer consigns his clip to be sold and pays a commission for the service. He is informed of prices offered the agent and, if the price is satisfactory, consents to the sale. The plan may bring greater returns than selling directly to the merchant. Its disadvantage lies in the fact that the grower must wait for the returns.

Growers who contemplate selling on consignment through an agency that also buys wool outright on its own account should investigate carefully before signing a contract. While many such firms, perhaps most of them, are honest, in some cases consigned wools have apparently been sold to the same firm that agreed to handle the clip on a commission basis. Also in the event of a widely fluctuating market, a firm that does both commission selling and speculation can sell its own holdings either first or last as conditions warrant, and consigned wools may not recieve equable treatment. Any firm that sells on commission should be regarded as an *employee* of the consignor until the sale is consummated; and as an employee the commission agent should be morally and legally bound to protect the interests of the consignor in every conceivable manner. Generally speaking, the consignment of wool to a speculative concern is thoroughly unsound and is to be condemned.

Commission selling through firms that do only a commission business is a logical method of wool merchandising, although few such firms now operate in the United States. Possibly the only reason why this method has not been widely adopted is that most growers desire to sell for cash at shearing time.

COÖPERATIVE WOOL-MARKETING AGENCIES

Because some producers feel that wool merchants have not paid so much for wool as market conditions warranted, many coöperative agencies have been created. The original hope of each such organization was to secure for its member patrons a price impossible of achievement by private and individual selling.

The wool grower probably knows less about the factors affecting the value of wool than the growers of any other agricultural commodity know about those affecting their product. His inability to evaluate his clip accurately is due to his lack of opportunity and time to acquaint himself with these factors, some of which require years of study and experience. Through lack of knowledge in arriving at true valuations, the grower is at a disadvantage as compared with the wool merchant, who knows the market and the influences that control it. Such a situation frequently produces dissatisfaction among growers who sell to speculative buyers and naturally leads to attempts to mitigate real or fancied wrongs. This, in brief, is the main reason for coöperative wool marketing, although some consistently patronize the movement from idealistic motives rather than from dissatisfaction with direct selling.

What Is Coöperative Wool Marketing?—In its simplest definition, coöperative marketing is marketing through the unified efforts of a

group of producers. If this definition is accepted, coöperative wool marketing has varied in its organization from pools, in which growers simply assemble their clips at one point for sale to the highest bidder, to concerns performing every service necessary in preparing and distributing the wool to the mills. In a more literal sense, coöperative wool-marketing agencies include only those organized to render the complete service of assembling and grading wool and distributing it on the market in an orderly manner throughout the season. Real coöperative marketing should assume the duties of the middleman. Unless the organization is prepared to do this, the service is incomplete.

Since the grower has no way of determining values accurately, it would seem logical for him to employ some agency capable of accurate evaluation to sell the clip in return for a fee. This basic idea underlies the existing true coöperatives of the United States today. The larger concerns assemble the wools, grade and warehouse them, and sell graded wools to mill customers. Advances provide the grower with cash. Complete returns are made after the wools are sold. Fleeces of similar grade, shrinkage, and character are pooled; but slight differences in the shrinkage of wools owned by various growers are accounted for on the return sheets. Clips above a given size, if uniform, may be sold as original bag lots.

The coöperatives are grower-owned and grower-controlled, the technical supervision being done by salaried employees well trained in the wool trade. Altogether the coöperative would seem an ideal opportunity for producers to market their clips in an orderly and intelligent manner. It would appear largely to correct the abuses of private selling and also to exert some legitimate influence on the market through its ability to feed the market as demand warrants. To perform this service satisfactorily, however, the management must be efficient and must maintain intimate contact with the patrons.

Reasons for Slow Growth of Coöperative Marketing.—The large number of coöperative or semicoöperative agencies organized in the United States during the past twenty-five years shows that growers are willing to try the idea. Yet the tonnage of wool thus marketed remains small in comparison with the total produced. There are several reasons why the organizations have not as yet enjoyed the patronage they may deserve: First, merchants have tried to discourage coöperative marketing. In addition, during the critical formative years of the coöperatives, market conditions have been discouraging. Of all hindrances, however, probably the chief one is grower psychology. The western wool grower is an individualist. He may hope ardently for the success of a coöperative wool-

marketing association and yet insist on selling his own clip privately even though he admittedly cannot judge its true value. He hesitates to entrust someone else with a clip he has spent a year in producing. If a wool merchant offers him a price that sounds fair by comparison with other sales in his locality, the desire for "spot" cash seems to be irresistible. Particularly is this true in years of high prices. At times country bankers press the grower to sell, although usually the banker knows no more about wool than the grower.

In times of stress, when wool prices are low and buyers inactive, many growers will ship to the coöperative, yet they will refuse when prices are good. The marketing agency, therefore, tries to make sales satisfactory to the growers in times of market depression while being denied the privilege of selling the same growers' clip in years when a good showing might be made. Undoubtedly the contract between the agency and the grower should involve continued patronage over at least five years. As experience has shown, however, the inclusion of such a clause in the contract so circumscribes the independent action of the producers that signatures cannot be obtained. Thus far, therefore, it has been deemed advisable to provide means whereby the grower can withdraw at the termination of any one-year period.

A few growers, either more far-sighted or more idealistic than the mass, patronize the coöperative consistently as a matter of principle. If any large number did likewise, the coöperatives could probably market wool to the satisfaction of all concerned. Success, however, depends not so much upon the loyalty of a few as upon the continued patronage of wool growers in general. Thus far the rank and file have not consistently marketed through the coöperatives, although many have used them as a pry on the dealer and have obtained higher offers by threatening to consign to them. The average grower who patronizes a coöperative gauges the success of his undertaking by a single unit—the price actually obtained as compared with the price at which he could have sold at shearing time. It matters not that market quotations may have declined seriously before the receipt and preparation of the wool for sale by the coöperative. The wool may bring a return fully commensurate with the market at the time it was sold, three months or eight months after the clip left the ranch; yet if the average grower could have sold it at shearing time for more money, he considers his dealings with the marketing agency to have failed and will probably withdraw.

Advantages of Coöperative Marketing.—A coöperative cannot promise a grower greater returns than he would obtain privately. It should be able only to assure him that his wool will be sold for its *actual market*

value at time of sale. It cannot even promise to secure a greater price on a level market than he would have secured privately at the same time.

As already pointed out, wool merchants tend to pay a flat price in any one locality, although this practice is less widespread than in the past. Probably it will always persist somewhat as long as the merchants employ local dealers in buying the smaller clips. Though defensible from the merchant's point of view, the practice obviously leads to paying too much for some clips in comparison with others; and a few well-grown, light-shrinking wools may sell considerably below their worth. The better clips, particularly those of light shrink, are the ones which the coöperative can handle to great advantage because each clip, presumably, is sold on its merits. The inferior wools have sometimes brought more money at private sale than the coöperative could hope to obtain for them.

On a rising market, merchants will become extremely active and will sometimes offer more than the wool is actually worth, anticipating a further rise in values. The coöperative cannot speculate. The average grower, on a rising market, therefore sells privately, although the coöperative, if the rise does continue, can give eminently satisfactory service. A falling market places the coöperative at a disadvantage, even though it can and does sell wool for its full value at the time of sale. The grower compares the price he received from the coöperative with the price offered by a merchant several months earlier before the market declined.

Growers of good clips of combing wools who patronize the coöperative consistently year after year should receive at least as high a net return as can be procured from a merchant. In addition, patrons of the marketing agency receive reports showing the amount of each grade present in the clip. Such information may be invaluable in determining how to bring about improvement through breeding.

In the past, the coöperatives have not been able to sell short defective wools, such as California fall wool and shorn lambs' wool, to the grower's advantage. In handling such wools the dealers on the Pacific Coast are in a more strategic position than the coöperatives. These wools are suitable almost entirely for woolens. Their relatively low clean value, their relatively high shrinkage, and the necessity of carbonizing nearly all of them have thus far enabled producers to profit by private sale to merchants equipped to process such wools before shipping.

Coöperative marketing undoubtedly tends to stabilize the wool market. The release of its holdings as the market demands is sure to benefit every grower. Unfortunately this is an intangible asset, whose monetary value cannot be definitely established. Its benefits are apportioned among patrons and nonpatrons alike.

Coöperative wool marketing as it exists today is relatively new. Speaking generally, it cannot be called a notable success because it has won the consistent patronage of only a few. It has operated during a series of difficult and abnormal years. Though it has many distinct advantages over selling by private treaty, it also has some disadvantages. Its continuation in the competitive field is highly desirable; its demise would be little short of a catastrophe. Altogether, the psychology of the western wool grower has prevented coöperative marketing from receiving a fair and impartial trial. The wool-growing industry needs wool merchants willing to pay ready cash for some clips, but it also needs the stabilizing influence of one or two great coöperatives.

RELATION BETWEEN THE PRICE OF WOOL AND THE PRICE OF CLOTHING

Wool growers and others often affirm that a drop in the price of wool should be reflected by a reduction in the cost of clothes. There is, however, only slightly more relation between the price of wool and that of a suit of clothes than there is between the price of untanned hides and the cost of shoes.

It takes about 3.5 yards of cloth to make a three-piece suit for a man of average size. Assuming that the cloth is a worsted of good weight, say 15 ounces to the yard, about 4.5 pounds of scoured wool would be required. If this cloth is made of fine wool from a range Rambouillet ewe, the shrinkage of the grease wool would probably be about 64 per cent, and the yield 36 per cent. The 4.5 pounds of scoured wool would then be the equivalent to $4.5 \div 0.36$, or 12.5 pounds of wool in the grease. If a nominal value of 30 cents a pound is assigned to the wool, the grower would receive $3.75 for the wool required. For the suit the grower would pay between $25.00 and $100.00, according to the care exercised in making it and the quality of its trimmings. If the price of wool dropped 20 per cent, from 30 cents, the cost of making the suit would be affected only to the extent of 75 cents. Growers who are asked to pay a seemingly high price for clothes should remember that the cost of converting raw wool into a finished garment involves an investment of many thousands of dollars in machinery alone and the employment of many hands. Some idea of the amount of manipulation needed to make cloth may be had from the fact that in certain types of suitings as many as twenty manufacturing processes are necessary *after the goods has been woven* in the loom before it is ready for sale to the tailor as finished cloth.

THE CALIFORNIA WOOL GROWERS' ASSOCIATION

The California Wool Growers' Association is purely a service organization; its members are free to market their wool or lambs in any manner they see fit. It employs a full-time secretary to promote the interests and welfare of the group. Funds are derived from annual dues based on the number of sheep owned by the member. A portion of the dues collected is turned over to the National Wool Growers' Association; thus each member automatically joins the national organization.

The state association publishes weekly for its members a periodical, *The California Wool Grower*. This brings to each member the latest market information, both domestic and foreign, on lambs and wool; timely discussions concerning sheep diseases; articles on sheep management, feeding, and other problems.

A partial list of the activities conducted by the Association, either alone or in collaboration with the National Wool Growers' Association and others, includes:

Sheep-disease eradication.
Predatory animal control.
State and county legislation on all matters pertaining to the sheep industry.
National legislation on all matters pertaining to the sheep industry, especially the tariff on wool and livestock.
Lamb marketing and wool marketing as influenced by trade practices of buyers, market information, statistics, etc.
Lamb advertising.
Wool promotion.
Transportation rates and regulations.
Relations with the United States Department of Agriculture Forest Service, and the federal Department of the Interior.
Maintenance of a supply department, through which members may secure supplies of all kinds necessary to the proper conduct of the sheep business.
An annual ram sale at which about 1,500 breeding rams are offered at public auction.
An annual wool show to which all growers can bring fleeces to compete for prizes and to be evaluated by wool experts.

The Association is administered through twelve district wool growers' associations whose presidents automatically become directors of the state organization.

GLOSSARY OF WOOL TERMS

Baby combing: see French combing.

Blending: mixing two or more lots of sorted grease wool.

Braid: the seventh and coarsest of the United States market grades of wool under the old nomenclature.

Britch wool: wool from the lower parts of the thighs, often coarse and hairy.

Carbonizing wool: the process of removing by chemical means the vegetable matter from wool.

Carding wool: short wools suitable for making woolens. Also, a process in manufacturing by which the wool is carded.

Carpet wool: coarse, hairy wools used in carpet manufacture.

Character: the crimp, handling qualities, and general appearance of wool.

Clean basis: the price based on what the wool will cost when scoured, but not including the cost of scouring.

Clothing wool: wool too short to comb economically.

Combing wool: wool long enough to comb on the English or Noble comb.

Common: the sixth of the United States market grades of wool.

Condition: the amount of yolk, dirt, and vegetable matter in grease wool.

Cotted: a fleece felted or matted before being shorn from the sheep.

Crimp: the natural waviness of the wool fiber.

Cross-bred wool: a term used in the United States to describe wools produced largely from a cross of long-wool and fine-wool sheep. In Australasia the term may mean any of the medium and coarse wools.

Defective wool: burry or seedy wool.

Delaine wool: fine strictly combing wool originating in Ohio and similar states, not necessarily from the Delaine Merino breed.

Fall wool: wool shorn in the fall of the year.

Fine: first of the United States market grades of wool. Also, wool of small diameter of fiber.

French combing: wool too short to comb economically by the English system but long enough to comb by the French system.

Fribs: small, greasy, and heavily conditioned locks of wool.

Frosted wool: a patented process for removing many natural impurities in raw wool, especially vegetable matter, by freezing and subsequent manipulation.

Frowzy wool: wool of lifeless appearance, lacking character.

Grade: the average diameter, expressed in arbitrary terms, of the wool fibers in a fleece.

Grease wool: wool in its natural condition; unscoured wool.

Half-blood, three-eighths-blood, etc.: the names of official grades of wool.

In bond: imported wool impounded by the federal government pending the payment of customs duties.

Kemp: a lifeless fiber produced in the fleeces of sheep and Angora goats. It may be associated with mongrel breeding. It will not take dye as wool does, and it has little value in manufacturing.

Line fleece: a fleece that in diameter of fiber is midway, or on the line, between two grades.

Locks: heavy, dungy bits of wool.

Lofty: wool that is full of life or shows many characteristics of the ideal.

Long-wool: wool from the long-wool breeds of sheep.

Luster wool: practically the same as long wool. Most of the luster wools grade as common or braid.

Medium wool: wool of medium fineness of fiber.

Noils: short fibers removed in the process of combing wool.

Off-sorts: the portions or sorts of a fleece that are less valuable than main or regular sorts because of paint, stains, etc.

Pulled wool: wool removed from the skins of slaughtered sheep.

Purity: absence of fibers other than white.

Quality: fineness or diameter of fiber.

Sack-burned: change to a permanent bright-yellow color by packing too moist. The change may also occur on the sheep's back.

Scoured wool: wool scoured to remove yolk, dirt, and other natural impurities.

Second cuts: short bits of wool resulting from shearing twice over the same area in an effort to clip the wool close to the skin.

Seedy: wool that contains a liberal quantity of seed or chaff.

Shorts: small, short bits of wool that fall in the process of sorting the fleece.

Shrinkage: the loss in weight that grease wool incurs in the process of scouring; shrinkage is expressed in percentage.

Sorting: separating the fleece into its various manufacturing qualities.

Soundness: the strength of the wool fiber.

Spinning counts: arbitrary numbers, such as 60's and 64's, denoting fineness of wool. Originally the figures signified the number of hanks of yarn that could be spun from a pound of top of that particular grade.

Spring wool: wool shorn in the spring of the year in those sections where shearing twice a year is practiced.

Stained: permanently colored from contact with manure or urine, or by bacterial action.

Staple: a lock or small sample of wool from a fleece. Also, in some western states, wool of strictly combing length.

Suint: dried perspiration from sheep, present in all grease wool.

Tags: heavy, dungy wool.

Tar: one of the off-sorts; made up of wool stained by the paint brands used on sheep.

Tender: lacking in tensile strength; unsound.

Territory wool: produced in certain western states, largely those in the Rocky Mountain area.

Timber-burned: fleeces blackened by the sheep grazing on cutover lands on which the stumpage has been burned or charred.

Top: a continuous untwisted strand of wool, made up largely of the longer fibers, resulting from the process of combing.

Woolen: fabrics or yarns made from uncombed wool.

Worsted: fabrics or yarns made from combed wool.

Yolk: the grease and suint in wool secreted by glands in the sheep's skin.

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